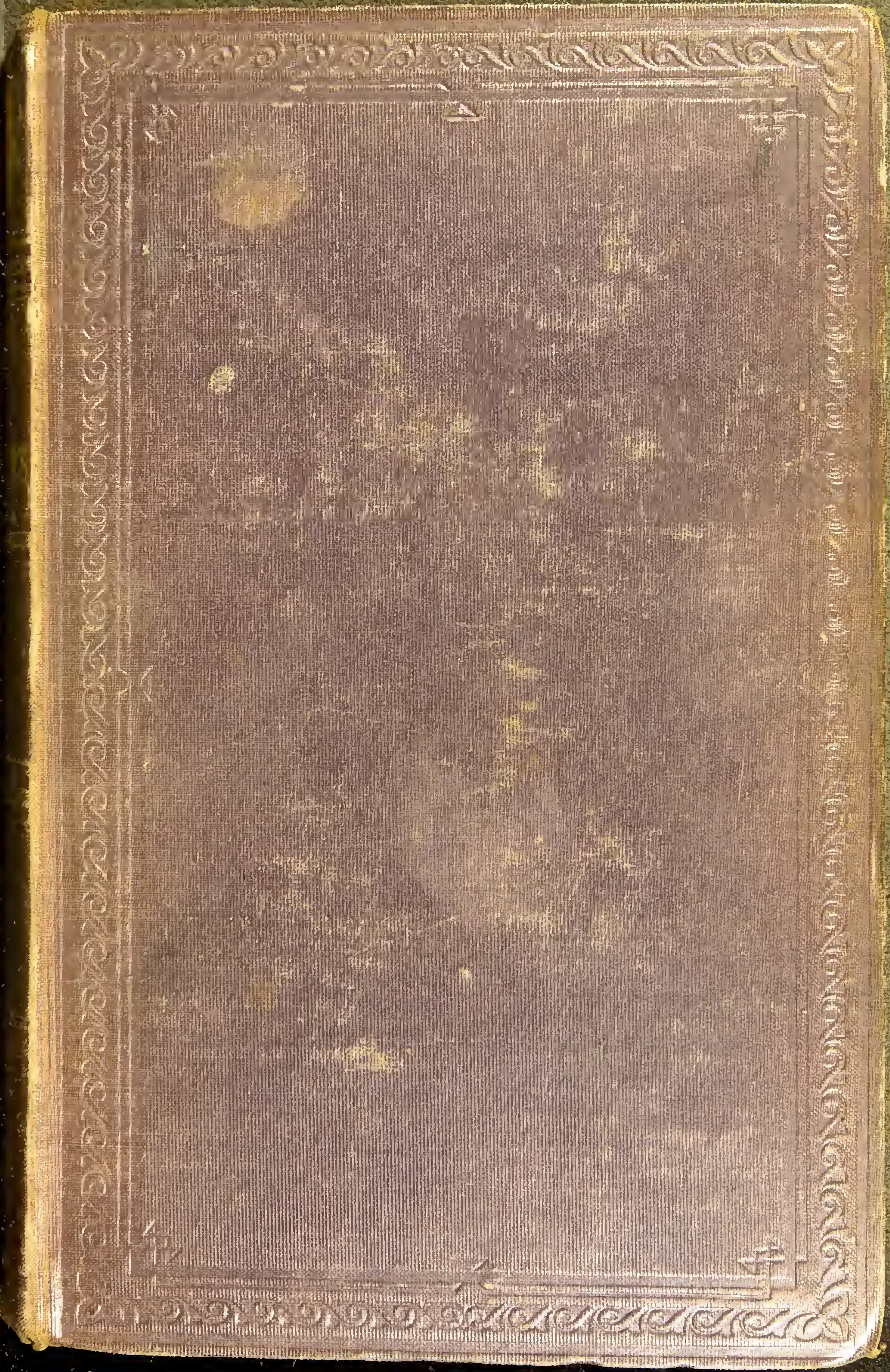

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LECTURES

ON

DEFORMITIES OF THE HUMAN FRAME.

LONDON:
PRINTED BY LEVEY, ROBSON, AND FRANKLYN,
Great New Street and Fetter Lane.

ON THE

NATURE AND TREATMENT

OF THE

DEFORMITIES OF THE HUMAN FRAME:

BEING A COURSE OF LECTURES

DELIVERED AT THE ROYAL ORTHOPÆDIC HOSPITAL IN 1843:

With numerous Notes and Additions

TO THE PRESENT TIME.

By W. J. LITTLE, M.D.

LICENTIATE OF THE ROYAL COLLEGE OF PHYSICIANS; LECTURER ON THE PRACTICE OF MEDICINE AT, AND PHYSICIAN TO, THE LONDON HOSPITAL; PHYSICIAN TO THE INFANT ORPHAN ASYLUM, WANSTEAD; FELLOW OF THE ROYAL MEDICAL AND CHIRURGICAL SOCIETY; MEMBER OF THE PROVINCIAL MEDICAL AND SURGICAL ASSOCIATION, OF THE HUNTERIAN, AND PATHOLOOICAL SOCIETIES, AND OF THE SOCIETA MEDICO-FISICA OF FLORENCE; FOUNDER OF THE ROYAL ORTHOPÆDIC HOSPITAL; ETC.

ILLUSTRATED BY UPWARDS OF 160 *ENGRAVINGS AND DIAGRAMS.*

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MDCCCLIII.

TO HIS

MEDICAL AND SURGICAL BRETHREN,

IN

GRATEFUL ACKNOWLEDGMENT OF THEIR KIND APPRECIATION OF HIS

ENDEAVOURS TO PROMOTE THE DIFFUSION OF

A PRACTICAL KNOWLEDGE OF THE TREATMENT OF DEFORMITIES,

THIS BOOK IS INSCRIBED

BY

THE AUTHOR.

PREFACE.

Fourteen years have elapsed since the author's *Treatise on the Nature and Treatment of Club-foot and analogous Distortions with and without Surgical Operation*,* appeared; from which period sub-cutaneous tenotomy has been generally received by the profession as an important addition to the resources of practical medicine.

An impulse was thus given to the reception in this country of Stromeyer's discovery† similar

* The first monograph published on this subject after the invention of sub-cutaneous tenotomy.

† In France, and amongst some English surgeons who have followed French writers, it has become the fashion to attribute to Delpech the discovery of sub-cutaneous tenotomy. The mistake is perhaps pardonable to our neighbours, who, in the confidence which great national claims in respect of surgery produces, do not appreciate the influence of German surgery upon their own practice; but it is inexcusable in English writers, who, in a question of science, are bound to take wider views. Between the times of Thilenius and Stromeyer no actual advance was made. Stromeyer alone discovered and first practised *sub-cutaneous* tenotomy, which is the only absolutely safe mode of operation.

to that which had been communicated throughout Germany by the dissemination of the author's observations and personal experience* of the method three years before in Berlin, and Dieffenbach's energetic adoption of it in that city.

In 1843-4 the following Lectures were published in the *Lancet*, which, as a contribution to the increasing desire of the profession to become practically acquainted with the pathology of deformities, the author regarded as a second edition of the treatise above mentioned. The desire to secure for these Lectures a more permanent position in medical literature, and to take date, as it were, for whatever of useful or original they may contain, has induced the author to republish them, and to interweave the results of ten years' additional experience. The Lectures are therefore reprinted with only verbal alterations, except where indicated; the new matter introduced into the text is enclosed between brackets; and the notes, the whole of which are new, appear at the bottom

Delpech had proposed to improve the operation of tenotomy; but his proposed improvements did not embrace *sub-cutaneous* section. They doubtless suggested to Stromeyer "materials for thinking." See Introduction to *Treatise on Club-foot*, &c. by the author.

* See the author's case of non-congenital equino-varus detailed in Stromeyer's Beiträge zur operativen Orthopädik.

of the pages. In order to reduce the extent of the work, many observations which might advantageously have been placed in the text have been supplied in notes. Through this arrangement, the author has found his labour augmented, without the certainty of having diminished that of the reader; for which the author solicits indulgence. From the same cause difficulty has been experienced in avoiding repetitions, and in placing the new matter so as to avoid interruption of continuity of subject.

In presenting to the Profession that which amounts to a third edition of the Treatise, the author cannot refrain from adverting to the altered position of the pathology and treatment of distortions at the present period compared with its state when Stromeyer commenced his labours. A host of able and zealous men, many of whose additions to science are quoted in the ensuing pages, have followed the path pointed out by Stromeyer; but no individual has experienced greater satisfaction at the triumph of the principles laid down by that distinguished surgeon, or felt more pride in having been permitted to assist in their diffusion, than the author. The following pages will prove that he has endeavoured faithfully to

perform the mission of "Apostel der Tenotomie"* entrusted to him by Stromeyer; and that, so early as 1843, having perceived a tendency to abuse of the method, he urgently discountenanced unnecessary employment of it.

The author avails himself of this opportunity of expressing his obligations to Mr. Gowlland for his able assistance, by the performance of operations, in conducting the subsequent mechanical treatment, and in contributing to the purely operative parts of the following pages.

* Opus cit.

34 *Brook Street, Grosvenor Square,*
April 1853.

CONTENTS.

ERRATA.

Page 89, line 23 from top, instead of *but* insert *it may*, and place all the remainder of the sentence from *through* to *sole* in a parenthesis ; dele *it*, line 6 from bottom ; insert *and* before *a*, and erase *s* from the word *results*.

,,	117	,,	18 from bottom, last word read *walking*.
,,	133	,,	3 from top, insert after *ligaments* the words, *and the posterior ligament of Winslow*.
,,	234	,,	8 from top, for *inferior* read *external*.
,,	290	,,	11 from bottom, for *ankle* read *angle*.
,,	297	,,	9 from bottom. omit *from before backwards*.
,,	302	,,	15 from top, omit *and* before the word *tibial*.

LECTURES

ON THE

DEFORMITIES OF THE HUMAN FRAME.

LECTURE I.

Introductory lecture — Importance of the study of deformities to medical students — Deformities not neglected by the ancients — More recent attention to the subject—Discovery of subcutaneous tenotomy by Stromeyer—Interest of the study of pathology of deformities—External resemblance of distortions produced before and after birth—Similarity of producing causes—Classification of deformities.

In commencing a series of lectures on the deformities of the human frame, I shall briefly allude to the circumstances which have occasioned their delivery. The charitable institution in which we are now assembled was founded in 1838, less than two years after the introduction into the metropolis of Stromeyer's improved method of remedying, by subcutaneous section of tendons, the deformity named *club-foot.* The principal reasons assigned by the supporters of the charity for establishing an additional medical eleemosynary institution in London, were the dispensation of that relief to poor persons afflicted with deformities which they were unable to obtain in the existing hospitals, the formation of a school for studying deformities, and instruction in the art of remedying them. Difficulties in forming the charity were not unforeseen. For my part, I was convinced that the best method of overcoming such prejudices as exist in the profession against the establishment of charities for treating special branches of medicine, would

consist in freely inviting its members to witness our proceedings and share its benefits. Our wards have, in consequence, been numerously visited by physicians and surgeons from all parts of the kingdom, and by many eminent foreigners. My own reward for assisting to form this institution has consisted in the resulting professional intercourse with so many enlightened individuals, in the many opportunities of investigating distortions of the frame here afforded me, and in the gratification experienced in delivering these lectures, and in acquainting you with the information that I have thus been enabled to acquire on the subject. The charity already presents to you a large field for observation. The average number of out-patients in almost daily attendance is upwards of fifty. Among them you may witness every deformity that occurs, principally in infants and children; while the more severe cases, usually those of adults, are admitted into the wards, where ten or twelve beds are generally occupied,—a number of patients amply sufficient for clinical purposes. I therefore hope that the medical students of London will, by attending a month or longer on this branch of practice, derive advantages that were not possessed by their predecessors. Deformities are not less interesting to them than diseases of the eye. Students, when in practice, will probably find equally numerous occasions of relieving congenital or acquired deformities as of curing affections of vision; and since attendance on an ophthalmic infirmary is justly considered essential to the completion of a medical education, so, in my opinion, students who, in the present day, leave the metropolis without adequate acquaintance with the treatment of deformities, will by and by lament the omission.*

Although the importance of studying the treatment of deformities has recently been more fully acknowledged, it

* The necessity for this attention to the study of the nature and treatment of deformities by at least the younger members of the profession, as a part of their daily duty, is further illustrated by the large number of applicants to the

was not neglected by the ancients: it was not omitted by Hippocrates, who shewed a correct acquaintance with club-foot in his treatise *On Articulations;* and his method of restoring an infantile deformity of this nature by bandaging, may be advantageously followed, in an appropriate case, in the present day. In truth, the methods of remedying infantile club-foot related by succeeding authors are but different versions of the precepts of the father of medicine. Several treatises on the cure of special deformities, or on malformations in general, were published during the eighteenth century, though few of them are entitled to rank as scientific works. At that period the art became a special branch of healing, and upwards of a hundred years since it received the title of the Art of Orthopædy.

With improvements in medicine generally, increased attention was given to deformities, particularly to congenital malformations; the radical cure of hare-lip, described by Celsus and the Arabians, became a common operation; other congenital fissures were restored by the *plastic art;* and the division of the sterno-mastoideus muscle, for the cure of wry-neck, was frequently effected by distinguished surgeons.

The uncertainty, the difficulty, and the frequent impossibility of curing many deformities, caused orthopædy to be relinquished by the regular surgeon to empirical practitioners entirely destitute of medical knowledge. Hence, even after the commencement of the present century, the

existing Orthopædic Hospitals in Bloomsbury Square, Hatton Garden, and Portland Road, who cannot be received into those establishments through inadequacy of space and funds. At the present moment (1852) *hundreds* daily receive relief as out-patients, and about fifty beds are constantly occupied by in-patients, free of expense to the sufferers. These facts strongly plead both the necessity of further pecuniary support to these charities, or the acquirement, by the bulk of the profession, of such an experience of the treatment of distortions as may discourage the over-ready applications to charities by those whose position in life, being above pauperism, should render them ineligible for eleemosynary aid.

treatment of deformities remained for the most part in perfectly ignorant hands. So neglected in general was the matter, that an unfortunate sufferer from a congenital deformity, after failure of some simple means adopted by the midwife or accoucheur, was happy, in many situations, in finding a common blacksmith who could partially relieve his infirmity by the construction of "an iron." Individual empirics and instrument-makers, by dint of greater perseverance, unquestionably obtained greater success in treatment than others; but their experience was either confined to themselves, being totally lost on the cessation of their labours, or, if they published any account of them, the work consisted usually only of announcements of their "remarkable cures," instead of the means by which other practitioners might reasonably expect success. A circumstance equally prejudicial to the art of curing deformities was the common habit of exaggerating the results of any really useful plan, less, in many instances, from studied dissimulation, than from the tendency to delusion in the empiric, who had, in truth, occasionally effected a cure that had not been attempted by a regular practitioner. Success in some cases created a greater evil, namely, that of professing to remedy more serious deformities. Failure in these brought discredit on preceding labours, and so retarded confidence in orthopædy. Thus the labours of the few talented medical men who devoted their energies to this subject did not receive proper attention. The names that stand foremost among the regenerators of orthopædy are those of Thilenius, a physician of Frankfort, who first [about 1789] caused division of a contracted tendo Achillis to be effected; of Scarpa, who first [1803] attempted the scientific adaptation of an apparatus to the *anatomical* condition of the bones of the distorted foot; of Michaelis [1811] and Sartorius, who repeated the operation of Thilenius; of Dupuytren, who investigated the pathology of contracture of the fingers, and improved the operation for

wry-neck;* and of Delpech [1823-29], who perceived the cause of previous failure, but who omitted to act on the principles he had adopted. The labours of Delpech, though calculated to arouse the attention of surgeons, remained apparently unheeded until they evoked the talents and ardour of Stromeyer [1830], to whom is due the discovery of *subcutaneous* tenotomy,† its application to club-foot, and its establishment as a *principle* in operative medicine.

An immense and rapid advance in the treatment of deformities has taken place since Stromeyer demonstrated the absolute safety of this mode of operation. The attempt to cure deformities is no longer disdained by medical men of eminence. Many of my own students have diffused the methods here practised in the majority of the British colonies and in some foreign states. Every month has increased the usefulness of the practical orthopædist. Tenotomy has now been successfully applied to every part of the frame [from which has resulted its indiscriminate use by some too sanguine practitioners]. Without exaggeration it may be stated, that at the present moment many of the most unsightly deformities can be cured with less inconvenience than any other class of afflictions at all comparable with deformities in the bodily and mental suffering they occasion. This improvement is attributable to increased experience in the mechanical treatment. Notwithstanding the prevalence of belief in the beneficial effects of proper treatment in relieving deformities, few practitioners are aware that such distortions as these (*shewing them*) can be so nearly approximated to symmetrical conformation as the models placed upon the table. The success which may now attend the treatment of deformities, and the extreme frequency of such malformations, should ob-

* Sir A. Cooper operated for contracted finger from diseased plantar fascia. He was unacquainted with subcutaneous tenotomy, and attempted to denude and remove the diseased parts by crucial incision and dissection.

† From τενων, *tendon*, and τεμνειν, *to cut*.

tain for the subject great attention amongst medical men. Moreover, it is not a dry subject, interesting merely as a branch of practice. The varieties, the etiology, and the pathology of deformities involve questions of the utmost interest to physiologists. The various abnormal forms of the human frame, and the manner of their production, are calculated to illustrate some obscure points in the nervous system. Here are four casts of *talipes varus*, each precisely [closely] resembling its neighbour in form, yet each has been preceded by different etiological and pathological events. Here is a similar series of the deformity, named *talipes equinus*, and there a similar collection of *talipes valgus*. Here is a model of a congenital deformity of numerous articulations, and there is one of a series of deformities occurring after birth, so entirely resembling the congenital case, that at first sight they appear to be identical. The study of the causes of changes that in form are so similar, their pathological analogies, and the probability and degree of their restoration, affords a new field of inquiry. Orthopædy is something better than a mere mechanical art; whilst employing its therapeutic resources, many of which are mechanical, the mind is also interested in problems that have hitherto been incompletely solved. In these lectures, however, I shall not tread the paths of theory and speculation, but keep strictly within the limits of practical utility.

The course is designed for students, and from the small number of lectures of which it will consist, must be confined principally to elementary and practical matters, becoming, in fact, a series of demonstrations of the subjects rather than formal lectures. As to the manner in which the subjects can be subdivided for the best comprehension of my views on the pathology and treatment of distortions, a topographical arrangement [in the usual manner of authors] would appear at first view to be the most simple. Thus I might commence with deformities of the

head and neck, and proceed *seriatim* to those of the hip, the knee, the ankle, &c.; but although simple, that plan would be too mechanical to diffuse much light on the pathology of the subject, besides occasioning many repetitions and confusion of the subject. An anatomical subdivision would be the most complete. Thus I might consider, first, the deformities arising from diseases of *the bones;* secondly, those resulting from diseases of *the muscular system;* thirdly, those arising from diseases of *the ligaments;* and in this manner successively review the influence of disease of the several tissues in producing deformity. But although this proceeding would offer the best guarantee of certainty and accuracy, I am doubtful whether the morbid anatomy of deformities has hitherto sufficiently progressed to enable me thus to classify these affections.* Besides this objection, you will find, on advancing in the study of distortions, that derangements of the osseous and muscular systems are so frequently combined as to render a strictly anatomical arrangement impossible.

In the present state of the science, therefore, I prefer a classification that is allied to the *anatomical*, namely, one founded on *the pathology of deformities.* It will, at one view, be found more suggestive of information relating to their nature; for although the etiology and pathology of some distortions is still involved in a degree of obscurity, inaccuracies are less liable to occur in referring them to pathological heads. Numerous deformities are congenital, a still larger number are acquired or developed after birth. Perhaps you will consider that *congenital* distortions should give to them a claim to prior consideration; and, indeed, the mystery attached to their origin has long almost exclusively attracted the investigation of distinguished anatomists and physicians. Popular emotion has at all times

* Nearly ten years have elapsed since the above was published. A work is announced in the press from the able hands of Mr. Lonsdale, in which he proposes to adopt the anatomical arrangement.

been powerfully excited by the view of congenital deformities, and they have been speedily brought to the notice of professional men; this affords an additional explanation why more frequent attempts at restoration have been made of these than of acquired distortions. But, in my opinion, if the non-congenital deformities had previously arrested their inquiries, they would, by studying the production of that which daily occurs to view, have more readily and correctly comprehended the origin of that which occurs secretly in the uterus. I shall commence with acquired deformities, believing that when conversant with these you will better understand the nature of congenital affections.

A constantly recurring cause of deformity is inflammation and disease of an articulation. The surgeon views with apprehension the progress of such a case, often proceeding, as it does, in defiance of every remedial measure. He witnesses the production of a contracted and immovable articulation; or even greater disorganisation of the ligaments and other tissues of the articulation having ensued, most serious deformity results. The pathological changes that have produced deformity are in those instances perfectly understood. Their progress being often slow, they can be conveniently studied and their respective influences determined. Hence the *first subdivision* of non-congenital deformities which I shall consider consists of those arising from *causes directly affecting the articulations.* This subdivision includes, therefore, the contractions induced by injuries or diseases of articulations,—all the various forms of stiff-joint, or ankylosis, the causes of which act primarily on the passive organs of movement, namely, the joints.

An equally numerous series of deformities results from causes which operate indirectly on the articulations. For instance, spasmodic affections of the muscles are familiarly known to the physician by inducing a contracted and immovable condition of the articulations influenced by those

muscles ; or paralysis of certain muscles will disturb the antagonising powers in a limb, inducing deformity. In these cases, the muscles being primarily affected, the articulations become secondarily involved. Cicatrices from loss of substance, as from gangrene, ulceration, burns, &c., excite deformity in a similar manner.

The *second subdivision* of non-congenital deformities consists, then, of those which arise from *causes indirectly affecting the articulations;* and in order to distinguish a case of this nature from ankylosis, I name it *contracture.*

A *third subdivision* of acquired deformities is to be found in the distortions arising from causes that simultaneously affect both the muscles and the joints [the active and passive organs of movement]; such are rachitic deformities, which you know to be *deformities from debility* [imperfect nutrition or assimilation].

Congenital deformities are divisible into two classes. I shall hereafter describe several distortions, of variable severity, induced, in my opinion [for the most part], by derangements of the nervous and muscular systems of the fœtus, independently of any absence or deficiency of parts, characterised, also, by their capability of restoration to a surprising degree of perfection. These I shall include under the head of *congenital distortions.* In the last category I shall consider those in which, whatever may have been the primary interruption of normal development in the fœtal parts, a total absence, incompleteness, or malformation of organs exists. These may be termed *congenital malformations.*

Every deformity of the human frame with which I am acquainted is referrible to some one of the above pathological heads. Some of my hearers may have observed that no direct mention has been made of distortions of the spinal column. But I have already stated my objections to a classification of deformities founded on *regions* of the body. Some distortions of the spine, moreover, are referrible to the first subdivision, namely, *ankylosis* [causes

directly affecting the articulations of the spine]; others are analogous to *contractures* [causes *indirectly* affecting the articulations of the spine]; while the greater number of spinal curvatures belong to the third subdivision of acquired deformities, namely, *rachitic distortions* [deformities from debility].* Here, for the present, I shall close the subject. In my next lecture I will furnish you with a diagram, which will serve to shew at one view the classification of deformities, and the plan of the course.

* At the establishment of the Orthopædic Institution (Bloomsbury Square), I introduced a system of registration of every case of deformity presenting at that charity. This has been continued since my retirement from the medical direction. The relative frequency of some distortions is shewn in a valuable publication of the medical statistics of the charity, by Mr. Lonsdale, in the *Medical Gazette*, June 1849, from which it appears, that of 7533 patients, there were affected with :

Curvature of bones of lower extremity (outwards)		1604
Genu valgum, or inward inclination of knee		1843
,, ,, combined with curvature . . outwards,	635	
forwards,	203	883
inwards,	45	
,, introrsum et extrorsum, one knee turned in, the other turned out		109
Talipes varus, affecting one or both feet		583
,, equinus		226
,, valgus, or flat foot		151
,, calcaneus		50
,, equino varus		112
,, ,, valgus		40
Compound varieties, such as Calcaneo-valgus, Talipes varus, and T. valgus of opposite feet, &c.		56
Contracted joints from inflammation or accident, wry-neck, &c.		634
Nervous affections of one or both sides, spasm, paralysis, or general weakness		138
Injuries of bones and joints from fractures, diseases of ditto, contractions from burns, &c.		89
Lateral curvature of spine	401	
Posterior ,, ,, ...	121	555
Lateral and posterior ,, ...	33	
Angular curvature ,, ...		444
Malformations of toes, fingers, &c.		16
		7533

LECTURE II.

General pathological phenomena witnessed in deformities—Meaning of contraction, morbid, transient, and permanent—Influence of repose of a part in producing contraction—Structural shortening, hypertrophy, atrophy, and adipose degeneration of muscles—Pathological changes in the bones and ligaments—Influence of deformity on the sound parts, on the physical and mental condition of the individual—Therapeutic means employed in orthopædy—Deformities from causes that operate directly on the articulations, namely, injury and disease—Deformity with complete and partial ankylosis—The mode in which contraction of parts in traumatic, phlegmonous, scrofulous, and rheumatic ankylosis is produced.

The following diagram will clearly shew the classification of deformities explained in my first lecture, and the plan of the course that I then proposed to follow :

Acquired Deformities.	Arising from causes *directly* [immediately] affecting the articulations.	Complete and Incomplete Ankylosis [from Accidents, Inflammation, Erysipelas, Rheumatism, or Scrofula].	Deformities of the Spinal Column.*
	Arising from causes *indirectly* [mediately] affecting the articulations.	Contractures from Spasm, Paralysis, Burns [diseased palmar, plantar, and cervical fascia, habitual retention in one position], &c.	
	Arising from causes *directly* and *indirectly* affecting the articulations . .	Rachitic Deformities, Deformities from Debility [mal-assimilation].	
Congenital Deformities.	Congenital distortions	Club-foot, Club-hand, Rigidity of Limbs of new-born Infants, &c.	
	Congenital malformations	Fusion or Absence of Bones of the Extremities, Supernumerary Parts, Abnormal Fissures, Monstrosities, &c.	

* The above classification was not originally put forth as a perfect means of arrangement of all known distortions and deformities. Probably no greater

Before proceeding to consider either of these subdivisions, I shall treat of some of the general pathological phenomena that may be witnessed in deformities. I shall continually have occasion to speak of contraction, because in *every* deformity certain parts are found either shortened and contracted, or elongated. The *morbid* contraction to which I here refer is sometimes a cause, at other times a consequence of deformity, and is not uniform in its nature. Thus, a *transient* spasmodic contraction of one or more muscles may produce a transient distortion, as in the face, an involuntary twitching of the levator labiæ super. alæque nasi, or of the levator anguli oris, and zygomatici, a distortion which ceases on the subsidence of the cause which excited the muscular contraction. Another example of temporary morbid contraction is sometimes afforded by the gastrocnemii producing an intermitting form of talipes, or club-foot. The limb, when examined during a state of rest, presents nothing abnormal; the individual can voluntarily flex and extend the ankle, but on attempting to walk, the heel cannot be properly applied to the ground, an involuntary transient spastic contraction of the muscles of the calf having produced distortion and lameness. I shall not at present detain you by explaining this interesting form of contraction, but shall proceed to speak of *permanent* muscular contraction.*

permanent success will attend a classification of deformities than any other part of the nosological system. The object contemplated was the diffusion of some light upon the large variety of distortions about that period suddenly brought into the domain of medical teaching, and the facilitating the comprehension of the pathology of the subject. The lapse of ten years has not shewn the above arrangement to be substantially incorrect.

* I have witnessed few well-marked instances of well-developed intermitting contraction of this kind. It frequently exists to a smaller extent in ordinary cases of spasmodic deformities, as, for example, in certain cases of talipes. The same phenomenon exists in certain general contractures of young children,—those produced, as it is probable, at the moment of birth, or during the earliest days of infantile existence. *See* Contractures.

Permanent muscular contraction may be induced in various ways. Long-continued repose of a limb in the flexed position has a tendency to produce a gradual shortening of the muscles on the flexed side of the articulations, so that on the attempt to resume the use of the member, a contraction of certain muscles is observed to exist, impeding the movement of the articulations. Or a spastic action of certain muscles of an articulation may arise from disorder of the nervous system, producing *constant contraction* of the muscles and constant distortion. Numerous other causes of this condition of muscles exist. An increase of bulk is an occasional accompaniment of the state of tonic contraction. The involuntary incessant spastic action of the muscle tends to an increased development of the fibrillæ and aggregate mass of the muscle in a manner similar to the effect of voluntary activity of muscle. This augmented bulk should not be confounded with the apparent increase of bulk produced by simple contraction of the belly of the muscle, consequent on approximation of its origin and insertion. After a certain duration of contraction, from whatever cause, the muscular fibres undergo certain changes in their intimate texture, which render them incapable of voluntary elongation whenever the cause of the contraction may be removed.

To this condition of contracted muscles I apply the term *structural shortening*. It would appear that under the influence of repose, the *origin* and *insertion* of the muscles being approximated, the muscular fibres become adapted in their length to the altered [topographical] relation of the parts of the member, and loss of elasticity, or of the extensibility of the muscular fibrillæ ensues. Structural shortening is succeeded by other changes, of which the most frequent is a diminution of bulk or wasting, to which the term *atrophy* is applied; and some pathologists are of opinion that atrophy of long continuance has a tendency

to induce a *transformation* of the muscular fibres, known as *adipose degeneration.**

* I append two of the most remarkable cases of abnormal increase of bulk of muscle, combined with contraction and adipose degeneration, with which I have been favoured. These were presented to me in consultation with Mr. Farish, of Lancaster Place, September 1847. The cases were those of two brothers affected with very general paralysis,—of the neck, trunk, the upper and lower extremities. The brothers were similarly affected in every respect; their disability differed in degree only, having been, on the whole, the most advanced in the elder.

For convenience of comparison, the particulars of both cases—the one a boy aged fourteen, the other aged twelve—are placed partly together and partly in parallel columns.

A. ætat. fourteen. *B. ætat. twelve.*

Both apparently born without paralysis or *deformity;* neither had fits.

A. was noticed by the nurse to present unusually large development of inferior half of the body, with large head.

"Just walked alone weakly from table to chair at age of nineteen months;" had previously "never crawled." Had been observed to be "lax;" unwilling to take exercise; had more difficulty in rising from the ground than his brother; was sluggish in physical and moral temperament.

With exception of whooping-cough, which occurred at age of six, enjoyed uninterrupted good health. Previously to whooping-cough, he had gradually acquired strength, and was able to walk three or four miles on a level surface, and even upstairs. The gait, however, was peculiar, his head and body having been inclined backwards, and "when sitting he was bent double forwards." He began gradually to decline after whooping-cough, was "for a time almost completely taken off his feet by it;" from the age of nine to eleven he declined even more rapidly, and altogether ceased to be able to stand. Until nine years of age the symmetry of the lower part of the body was very good; he still possessed power of locomotion, which was effected "on the toes," especially on the right toe (talipes equinus), the left foot at the same time "beginning to roll" (talipes equino-varus). At the age of eleven and a half *the muscles of the calf were as large as those of a well-grown man, whilst the ankles were as small as those of a healthy boy of his own age.* The lower extremities have usually been cold, especially the left foot; has complained of sen-

B. did not walk alone until the age of two years and a half; "previously he shuffled along the floor." He had previously had measles, varicella, and symptoms of mesenteric disease; he also cut teeth with difficulty. He had been so weak, that his parents had despaired of his recovery.

From the age of five to eight he gained strength, at nine rode on pony; and although the general health was so indifferent that he seldom for three weeks in succession was free from "a cold" or "a bilious attack," has been stronger in his limbs than his brother, and did not altogether cease walking until six months before the present time. Was observed to be stronger during winter than during summer.

The effects of structural shortening are more striking in children than in adults. In both, wasting results from

sation of "pins and needles;" at one period the feet and legs could be pinched without his being aware of it. Sensation is now perfect. Contraction "behind the heels" appeared to commence at age of six, and has gradually increased to the present period. The shoulders appeared loose, and upper arm very small, "so that a stranger would fear to grasp him by the arms."

Both of these children lie supine the greater part of the day, occasionally sitting in an arm-chair suitably contrived for supporting the weak trunk. Both, when raised into a standing position, are so generally paralysed as to be incapable of supporting themselves. The vertebral column in both collapses and curves when unsupported, diminishing the length of the trunk, in the elder child to the extent of six inches. Constant slight curvature of lower dorsal and lumbar vertebræ to left side.

He can remain a few minutes unsupported sitting on the edge of a chair, in which position he appears more upright than when seated farther back on the chair; the head is held upright, but when he is recumbent he uses much labour to raise it from the couch. Atrophy generally of both shoulders and upper arms exists, except that the deltoids, two inches below their origins, are larger in proportion to the remainder of the shoulders and upper arms; these muscles, however, do not possess any voluntary power. Slight contracture of both elbows, and slight contraction of pronators of both arms. He can raise the right arm only as high as the epigastrium; the left is weaker, aod ean only be brought to the chest by a jerking movement, in doing whicb assistance is derived from some of the muscles of the trunk. He possesses very slight power in shoulders or elbows; more in wrist and fingers. He can reach his mouth and feed himself by resting the elbows on table. He can touch his head by alternately helping cach hand with the other.

The *muscles of the calf are at present larger than those of a heatthy boy of same age;* he possesses power of volition in them; slight volition also apparent in anterior tibial, long and short extcnsor muscles of thc toes, although thesc muscles are overcome by the contracture of thc calf. Is unahle entirely to close knees, although by successive small inward rotations of femurs he can almost bring them into contact. Thc pupils are large; sight good.

Head said to be less heavy, although when recumbent is unable to raise it.

On examination, for the sake of comparison, of the amount of voluntary power possessed, the principal difference is that the younger child can more readily and more completely effect the samc movements as the elder. The younger, when *placed* on the ground in the kneeling posture, the elbows and body resting on the edge of a chair, can support himself for three or four minutes in that position, and approach the right knce four or five inches towards the chair, but cannot, even in this position, effect locomotion.

Both are very intelligent; read and write; speech perfect.

A few days after this consultation I was informed that the elder child had

want of exercise, but in children additional impairment of the muscle takes place from the interruption offered to the normal development. The study of these pathological changes, namely, transient contraction, constant contraction, hypertrophy, structural shortening, atrophy, and adipose transformation, often occurring in the above order of succession in the same distortion, is of importance in the diagnosis, prognosis, and treatment of deformities in general.

Structural shortening and diminished growth of one or more of the principal muscles of a limb, by affecting the activity of the member, impairs its vegetative functions; hence a more or less considerable diminution of temperature is observed in all extensive deformities. The symmetry of the frame is destroyed, particularly in those distortions resulting from disorder of the nervous system, in

sunk rapidly under the attack of an acute internal disorder. At the autopsy the gastrocnemii and solei were found to be uncommonly large, colour whitish yellow; traces only of muscular tissue; the mass being composed of adipose matter, apparently occupying, for the most part, the areolar tissue; the posterior tibial, flex. long. poll. and flex. comm., presenting a slightly pink colour, were less degenerated than gastrocnemii and solei. The deltoids and sterno-mastoids as much changed as surales. Tendons unaffected. Spinal muscles small, but unchanged in structure. Interior of brain and medulla spinalis apparently healthy. Sheath of cord contained from four to five drachms of serous fluid. Beneath squamous plate of right temporal bone and adjacent portion of parietal bone, a plate of bone, concave internally, convex externally, resembling squamous portion of a temporal bone, but thinner, was found. This abnormal plate was externally invested by layers of dura mater, to which it had remained attached on removal of calvarium; internally it was lined with arachnoid. Convolutions flattened and depressed, corresponding to the plate. Visceral arachnoid thickened, in many places opaque, with distinctly-organised deposit, as if from chronic inflammation. Numerous "glandulæ pacchioni." The degenerated muscles exhibited abundance of fat cells, with few traces of muscular fibre; in some fibrillæ the transverse markings were scarcely distinguishable, in others they were quite distinct. Dr. Parker, who kindly submitted these structures to a minuter examination, detected "granular" evidences of inflammation in the matter scraped from arachnoid. The abnormal plate presented lacunæ of the form of those of fœtal bone.

which one side of the body has at some period participated. The muscles on the uncontracted side of the member suffer not only by remaining inactive through the want of antagonists, but are further weakened by the mechanical elongation to which they are subjected.

I have thus far described the anatomical changes occurring in muscles from deformities in general; the influence of deformities on the bones should also be considered. Observation shews that these structures suffer in their long and transverse measurements in proportion to the degree of inactivity to which the member has been subjected. The textures composing the articulations undergo numerous alterations, both primary and secondary. These will be more fully described in the subsequent lectures; but to complete the outline of the pathology of deformities, the shortening of some ligaments and the extensive elongation of others, even to the extent of permitting a partial luxation of the articular surfaces, the abrasion of cartilage and bone, the formation of "new joints" should be enumerated.* The effects of pressure and friction in producing callosities on parts that are not naturally adapted for such usage, and the contrary effects of disease on parts that are intended by nature for pressure, may for a moment occupy your attention. The plantar surface of the adult labouring under the highest grade of club-foot remains as delicate as the palm of the fairest of the sex, whereas on the restoration of the member the cuticle and cutis of the sole undergo the changes necessary to fit the part for treading and locomotion.

The influence of deformity of one member on the opposite sound part is not void of interest; thus for a time an unusual healthy development takes place, sometimes succeeded by a deformity different from that of the part first affected. The deficiency arising from congenital deformity of one hand or foot is in some degree compensated for by the perfection attained by the unaffected organs; but in

* See Plate I. at end of volume.

single club-foot, for example, it often happens that the disproportioned amount of weight borne on the sound foot produces ultimately that change in its tarsal arch which constitutes flat-foot.

The effects of distortion on the physical and moral condition of the individual is one of deep interest. It is undeniable that the consciousness of an infirmity of this nature has displayed itself in a most marked manner in many individuals who have been thus affected. Historians have described the influence of deformity in alternately stimulating the cultivation of the worst and of the best passions and instincts. The impeded development of the trunk from extensive deformity, or wasting of a member during the growing period of life, often appears to occasion in the system a reserve-fund of nervous and nutrient energy, which may be devoted to the elaboration of those parts the development of which is not impeded. Hence the mental vigour and surprising activity of the unaffected organs. Deformity of a part of the body may produce effects on the mind in a manner similar to those of a moderately sedentary mode of existence, the nervous and nutritive energies, unexpended in the muscular system, being employed to develope and sustain the mental faculties.

[The phenomenon of which the explanation is here attempted may probably arise from a circumstance of more general application — the anatomico-physiological state of the nervous system. It cannot be doubted that mental activity, in whatever direction it be exercised, is, as well as corporeal activity, influenced by the more or less extensive development of portions of the nervous system; and the study of pathogeny shews that the liability of an organ to disease increases with its physiological development. This view should, however, be qualified by the consideration, that to a certain point development and functional activity produce only the highest degree of healthy action; but when excited beyond this physiological degree the action becomes morbid. Many distortions originate from mala-

dies of brain and spinal cord; others appear at least to have been remotely influenced by the nervous system of the parent, or of the affected individual.

From these considerations the influence of certain deformities upon character may be regarded as an incorrect expression of a presumed fact. It should rather be stated, that the character of the individual and the deformity, instead of standing in the relation of cause and effect, result both of them from a peculiar condition of the system of the individual, and in particular of the nervous system. It is also possible that statistics would shew that the connexion between deformity and character is only accidental; marked character, when coinciding with external physical infirmity, having prominently attracted observation.]

Derangement of health, consequent on the various injurious influences that I have considered, frequently augmented by compulsory sedentary habits, is of frequent occurrence. The protean disorder *dyspepsia*, and its companions hypochondriacism and melancholy, frequently require special applications of the resources of medicine.

[Hysteria is often superadded to spinal deformity; and perhaps hysteria is never more puzzling to the practitioner than when thus associated. It assumes the form of incapacity to bodily exertion, intense neuralgia, paralytic loss of power, extreme sensibility to cold, and in short aggravations of all the ordinary symptoms which may accompany the distortion.]

Before detailing the nature and treatment of the first subdivision of our subject, the deformities arising from injuries and diseases of the joints — ankylosis — I shall offer some remarks on [the objects and] the therapeutic means that are employed in orthopædy.

[Orthopædy (ορθον παδιον*); orthopédie, *Fr.*; ortho-

* Andry, Dean of the Medical Faculty of Paris about 1744, who first used the term "orthopædy," states that he constructed it from the Greek words above given. Kraus, in his Lexicon, puts forth παιδος (genitive of παις), instead of παδιον.

pädie, *Germ.;* ortopedia, *It.*,—the art of removing deformities in young children, extended in the present day to the treatment of deformities in persons of all ages; a branch of the healing art employed by the Egyptians, the Greeks, especially by Hippocrates (p. 3); unnaturally raised, however, to a speciality in modern times through the neglect of it by leading men in different countries. This neglect was probably due to the difficulty encountered in accomplishing the curative objects of the art at a period when the anatomy and pathology of deformities were not understood. Orthopædy, by its employment of gymnastics, touches, on the one hand, the art of hygeia, and on the other, by the use of tenotomy, reaches to operative medicine or surgery in general, whilst by the continued attention to the condition of the frame required for the cure of many rachitic and paralytic deformities, it follows the path of practical medicine.* The great impulse given to the study and treatment of deformities by the discovery of subcutaneous division of tendons and muscles by Stromeyer in 1830, has secured in the service of orthopædy the labours and researches of numerous able men, and a consequent extension of the means of relieving deformities, and promises to lead to discoveries by which some distortions yet incurable may ultimately be removed from the list of opprobria of our art.

Orthopædy has reacted beneficially upon general surgery, by shewing that many operations *de convenance, e.g.* amputations of fingers or entire limbs for removal of deformities of these parts, formerly orthodox, are in the present day unjustifiable, and by demonstrating the greatness of the results obtainable by well-conducted graduated application of force or pressure to articulations in preventing deformity during diseases of articulations. Moreover, as the majority of such deformities of extremities are, where incurable, at least partially remediable, an important ele-

* Whilst discouraging the view of orthopædy as a speciality, it cannot be denied that advantage may result from delegating certain functions to the rubber and instrument maker.

ment in deciding on the propriety of amputation of a diseased joint—namely, the circumstance so often formerly advanced, that if recovery ensue from the disease of joint, the limb will remain deformed and useless—is now removed, and many diseased joints formerly condemned are thus, by the greater skill and perseverance of the surgeon, saved.

Orthopædy embraces a large field of practice,—the removal of congenital deformities, those acquired from disease or injury, through weakness of bones, ligaments, and muscles, spasmodic and paralytic affections. The relief of certain convulsive affections, such as stammering, certain chorea-like affections of the hand and other parts, find their way to, and often their removal at, the hands of the orthopædic practitioner.

Until a recent period—the last sixteen years (1852)—the treatment of many of these affections, when attempted by otherwise able practitioners, was commonly conducted in as empirical a manner as by the commonest charlatan. Without any clear ideas of the pathological phenomena requiring to be modified or removed, the surgeon, if not deterred from interference with a deformity through the fear of encountering hopeless malformation or ankylosis, regarded the case as simply a mechanical change of form, and treated it solely upon mechanical principles. At present the objects proposed by orthopædy consist in facilitating the absorption of plastic matters which impede the movements of parts, in altering the length and direction of cicatrices, ligaments, fasciæ, tendons, muscles, &c., the form of bones, the development or re-excitation of weak muscles, or the restoration of the equilibrium between associated or antagonist muscles.

We will briefly survey each of these proposed objects.

One of the commonest impediments to the restoration of form, mobility, and usefulness of a member, after inflammation, consists in the effusion of plastic matters in and around articulations, by which the natural movements are

obstructed, the plastic material becoming more or less indurated according to the nature of the inflammation and the time that may have elapsed since the mischief occurred. This effusion, when simply located among the ligaments, tendons, &c., occupying the interspaces afforded by the areolar tissue, is very commonly re-absorbed soon after subsidence of the inflammation, or it may leave those parts unnaturally agglutinated by its becoming organised, forming a new tissue, or so-called *adhesions*. It is also probable that, as one of the effects of inflammation, the usually flexible ligaments and the elastic muscular tissues undergo some molecular change, by which these properties of flexibility (ligaments) and susceptibility of ready elongation (muscles) are temporarily sacrificed.

The relative length of the various ligaments, fasciæ, and muscles in the vicinity of the joint is usually much affected in the progress of inflammation of a joint, and the restoration of the normal proportions between these parts is consequently one of the objects of orthopædy. So large an amount of deformity being commonly witnessed, and so great resistance to alteration of the position of the limb being manifested during the inflammation, many writers on diseased articulations have supposed that a peculiar spasmodic irritation of the flexor muscles of a joint existed, by which they have accounted for the shortening of parts, the deformity and even the sub-luxations so frequent in inflamed joints.

The mode in which the relative length of parts is disturbed is intelligible without the supposition of any spasmodic irritation of muscles. It is simply necessary to remember, that so long as the ligaments of an articulation retain their normal structure and action, the muscles possess no power of changing the position of the articular surfaces and of the limb beyond the movements natural to the part. When an articulation is inflamed, the effusion into its interior distends the synovial sac, necessarily sepa-

rates the articular surfaces, elongates the ligaments, (probably already involved in the inflammatory process, and themselves altered in their cohesion, and therefore disposed to yield,) deprives the muscles of the basis of their actions, —viz. a suitable degree of fixity in the joint; abnormal movement of the parts is now practicable, illustrated by the sufferings experienced on accidental motion of the limb; the patient probably strives to give that security to the joint no longer afforded by the articular tissues, and by instinctively acting upon those muscles which are either normally the stronger set of muscles, or which the configuration of the parts favours, obtains a comparatively easy position. In addition to the share which the will of the patient may have in altering the form of the part, it is probable that when the will is inactive, the involuntary power of the muscles is exercised to bring the origin and insertion-point of these organs into closer contiguity. In some articulations nearly all the muscles contribute to contraction and deformity. Thus, in the hip-joint, after adequate destruction of articular structures has taken place, the majority of the muscles which connect the femur and the tibia with the trunk tend to shorten the member. Sometimes we can study in the deformity itself the share which a particular muscle has exercised in its production. Thus in ankylosis of the knee we often recognise the greater influence exercised by the biceps femoris from the peculiar outward rotation of the leg produced by that muscle. The peculiar attachment of the crucial ligaments has probably also some share in determining the abnormal position of a knee thus affected. *See* Knee Contracture.

The restoration of the direction of articular surfaces is a frequent object of orthopædy, and often one which is effected with comparative facility.

Thus, when in children, from imperfect nutrition or assimilation, the muscular and ligamentous tissues are weak, and particularly if this weakness of ligament and muscle

be associated with stoutness, the articulations of the lower extremities especially become deformed, producing the affections known by the names genu valgum (in-knee) and talipes valgus spurius (flat foot), which an appropriate treatment promptly relieves. The separate articulating surfaces of the ankle and tarsal articulations, in club-foot, for example, are often much changed in direction, constituting a circumstance requiring the utmost attention during treatment.

In other instances, in which the direction of articular surfaces is altered, as in severe or complicated curvatures of the spine, restoration is a matter of extreme difficulty, and is often impossible.

The restoration of the form of bones is a less frequent necessity in orthopædy than was formerly believed. It is now known from the dissections of Blumenbach, Palletta, Colles, Scarpa, and of myself, that even in the worst forms of club-foot the form of the principal bones is little changed, compared with the deformity of the member. Morbid anatomy and experience in the cure of ankylosis have demonstrated that, even in deformities after disease and injury of joints, the soft parts are usually more implicated than the bony structures.

Rickets is the principal contributor to the necessity of altering the form of osseous textures; from this disease extreme deformity often results, and whenever situated in shafts of long bones is directly amenable to treatment, provided *eburnation* has not taken place. Long-standing extreme spinal deformities oftener present insuperable obstacles to restoration, owing to alteration of bones.

In the greater number of deformities, especially in the various forms of spasm and paralysis, in which the head and extremities in particular are so frequently involved, orthopædy is furnished with the opportunity of endeavouring to effect the remaining objects enumerated—that of the re-excitation and development of weak muscles, or the pro-

duction of equilibrium between sets of antagonist and associated muscles.

Although a matter of minor importance, the artificial restoration of the length of shortened limbs should be here mentioned.

Of the means resorted to in the treatment of deformities.

In the infancy of orthopædy the measures employed for the relief of deformities were comparatively few. The gymnastic medicine of the Greeks was doubtless not simply employed as a branch of hygiene to prevent disease and deformity,—as a part of therapeutics in the relief of chronic disorders and debility,*—but as a means of rectifying physical alterations of the frame. Hippocrates, whether or no he attempted division of tendons in the cure of club-foot,† has left upon record in his treatise‡ *on Articulations* an excellent description of the process of bandaging to which he resorted, and with which, doubtless aided by manipulations of the part, he frequently effected a cure. From the

* In the present day we have specialists who devote themselves to the professed cure of internal disorders by gymnastic exercises. If we cannot tolerate the empirical use of gymnastics and *its* claim to be considered the philosopher's stone of practical medicine, we can recognise the too common neglect of corporeal exercise in urban, and even in rural society, and admit the value of a course of moderate and appropriate gymnastics to those who cannot without the stimulus of novelty be induced to make bodily exertion. In this matter, as in the analogous so-called systems of Mesmer, Hahnemann, Preisnitz, in the Molken-Cur, &c. &c., the rational or eclectic physician, whilst utterly repudiating the claims of these *systems*, may be reminded that the particles of truth which these empirics have each selected from the accumulated stock of knowledge of the fathers of medicine, have often been neglected by individual regular practitioners. It would be wonderful were it otherwise; for so numerous are therapeutic agents, that the practitioner learns to confide most in those he has most frequently employed, and neglects those to which he is unaccustomed.

† Symbolæ ad Talipedibus cognos. W. J. L., Berolini, 1837.

‡ Vide Sydenham Soc. translation of the Works of Hippocrates, by F. Adams, LL.D., Surgeon: vol. ii. on Articulations.

period of Hippocrates until recent times little appears to have been effected for the improvement of the art; during the last century several original minds (Venel, Brückner, Wantzel, for example,) devoted themselves to the manufacture of improved apparatus for correcting deviations, or, as the result shewed in the majority of cases, for simply supporting deformed members, and enabling their owners to effect locomotion, and otherwise mix in society with greater facility.

In the present day the proper available resources of orthopædy consist of manipulations, baths, inunctions, gymnastics, mechanical instruments, forcible extension with aid of anæsthetics, division with the knife of resisting structures, electricity or galvanism, and retaining apparatus.

On Manipulations.

Mellet,* one of the most practical writers on this subject, says, "les manipulations sont l'âme, la partie essentielle de l'orthopédie; et sans elles, il est bien peu de difformités qui guérissent par l'emploi seul des appareils mécaniques." This assertion is equally true, even with the advantages afforded by the discovery of other means than mechanical apparatus. Manipulation may be regarded as the natural remedial agent for a deformity, that which in the rudest state of society is instinctively employed. Being simple, apparently easy of application, free from obscurity, manipulations have not in the present day received the attention they deserve; they alone suffice for the rectification of slight genu valgum or knock-knee, and recent curvatures of the shafts of bones: combined with bandaging, they cure slight congenital deformities of the limbs, or with bandaging and mechanical apparatus, severer cases of deformity of numerous articulations. In deformities requiring operation, or long-continued use of mechanical

* Manuel Pratique d'Orthopédie, 1836.

apparatus, they are indispensable for the obtainment of the full benefit of the surgical operation or of the apparatus employed. They are for the most part grateful to the feelings of the patient, enable him to bear the continued restraint of instruments, relax or set free the structures of the limbs, which are more or less benumbed or painful through incessant pressure of instruments, facilitate the circulation in the blood-vessels and lymphatics, procure suppleness to the articulations, and assist in giving them a favourable direction, and the habit of normal movement, such as they will have ultimately to maintain without assistance. In order to be successful with manipulations, the "rubber" must proceed with study and gentleness; he should practise regular movements only, have recourse to them daily, or in some cases several times daily. Without the use of manipulations the practitioner has often been mortified with the discovery, that although he has obtained a straight member, it has been rigid, as if ankylosed, extremely painful when passive movements have been attempted, and but slowly restored to mobility. A member left too long neglected in mechanical apparatus without manipulations, may remain ever afterwards deprived of that extent of motion in the joints which is necessary for the recovery of full muscular development, and consequent strength and usefulness.

Each deformity requires a particular form of manipulations, which will suggest itself to every medical practitioner.

Shampooing is related to manipulations, to which it mainly owes its efficacy; for in proportion to the extent to which the shampooer adds flexion and extension movements to those of kneading the muscles, will he succeed in his object.

Baths.

As deformities for the most part have contracted physical alterations during their progress, it would be unrea-

sonable to attribute to the local or general application of warmth and moisture any considerable beneficial influence in the cure of deformities. From all times, however, these means have been largely resorted to with approbation. We may trace the custom, still prevalent in remote parts even of this country, of thrusting the paralysed and distorted limb into the paunch of a recently slayed animal to the Egyptians. Possibly the popular idea of the value of this means is not limited to considerations of warmth and moisture, but may attribute to it some mysterious translation of the ebbing vital properties from the body of the animal to the almost lifeless paralytic limb. We may admit the aid afforded by warmth to the languid circulation and nutrition of the impaired part, the stimulus imparted to blood-vessels and absorbents by warmth and moisture, by which the removal of effused and useless materials is in some deformities hastened, the possibly soothing influence in functional disturbance of the muscles themselves, the ruder manipulation which the patient will tolerate in the bath; but after all, it must be admitted that baths, local and general, are but auxiliaries upon which too great reliance, to the neglect of more effective means, should not be placed.* The cold douche has been largely employed; the primitive mode of employment having consisted in bringing the maimed part beneath a natural falling stream, or beneath a common pump, until the sufferer, if

* The author is unable to speak favourably of much warm bathing of members whilst undergoing instrumental treatment. He has found that immersion in warm water of the parts previously compressed by an apparatus induces tumefaction and increased sensibility, interfering with the proper replacement of the apparatus. Ablutions are necessary for cleanliness, and the comfort of the patient demands the occasional sacrifice of some time for the purpose; but in *severe* deformities, requiring steady persistence in mechanical treatment, warm bathing should rarely be used. Free washing of the compressed limb with undiluted spirits of wine answers the purpose of cleanliness, cools the limb, refreshes the patient, and may be substituted for every other bath during active instrumental treatment.

young, often shrieked with agony. The self-distinguished hydropath has invented numerous mechanical contrivances to effect a similar purpose. The cold douche of spring or sea-water judiciously applied, short of acute suffering, if quickly followed by reaction in the feeble member, may prove beneficial in restoring tone to it. The contractions and deformities in which the cold douche is often applied are commonly of a paralytic or spastic nature. In these cases it should be remembered that the seat of the diseased action is usually in the brain or spinal cord, and that consequently treatment at the periphery is not likely to succeed. It is right to caution the inexperienced against unguarded application of cold either to the affected limb or to the vicinity of the central organ. The remedy is most potent for evil. The author has witnessed aggravation of disease of brain and spinal chord clearly traceable to extensive use of the cold douche to the spine.

Inunctions.

The consideration of inunctions of various substances, medicated or otherwise, for the relief of deformities, may be briefly dismissed. They are undoubtedly useful in promoting absorption of effused materials; they are the vehicles of counter-irritation in paralytic and spastic contractures; they combine friction with manipulations, stimulate the development of caloric in the part, and favour capillary circulation. The substances most proper for inunction are iodine, camphor, ammonia, lytta, turpentine, and sometimes mercury.

Gymnastics.

Gymnastics, alternately vaunted and decried, will ever hold an important place in the estimation of the orthopædic practitioner.

We may include under gymnastics every species of

voluntary exercise of the muscles which is calculated to restore power or harmony to the movements of the limbs and trunk. Gymnastics consist of the patient's voluntary active (artistic) use and exercise of the muscles, and are the complement to manipulations, which consist of passive movements performed by another person, or, when practicable, by the hand of the patient himself.

The occasional depreciation of gymnastics has naturally resulted from the tendency of the professors (!) of the art to over-estimate its advantages, and to undertake to effect impossibilities—the cure of serious deformity by its means alone. Sometimes also gymnastics have been pushed to the extent of permanently impairing the vigour of the frame of the growing youth. It may almost be said of some of the modern gymnastic teachers that which is re-
[illegible] (?) corded of Herodicus by Plato, that he destroyed himself and many others by undue gymnastic exercises. An occasional accident during violent gymnastics has also tended to diminish confidence in their employment. The application of gymnastics to each deformity will be found in its appropriate place. *See* Spinal Curvature, Wry Neck, &c.

Mechanical Instruments.

Until recently the employment of mechanical contrivances constituted the most influential means of rectifying deformities possessed by the orthopædic practitioner; and notwithstanding that subcutaneous tenotomy and myotomy enable surgeons in the present day to effect more in one minute towards the cure of many deformities than was formerly accomplished during months' and years' assiduous use of instruments, the complete restoration of a deformed part is usually only possible when the surgical operation is succeeded by appropriate mechanical treatment. In addition to this necessity of mechanical means as an adjuvant, and as an indispensable means of per-

fecting restoration in cases in which an operation has been performed, the profession is still indebted to the labours of the instrument maker for the means of curing, without the necessity of operations, many deformities arising from contracted muscles and tendons, such as the slighter cases of club-foot, and numerous deformities of bones and articulations arising from weakness and rachitis.

The orthopædists who practised before the discovery of subcutaneous tenotomy—a discovery which has since revolutionised the treatment of deformities—had to a great extent perfected the manufacture of instruments. The important influence in the cure of deformities exercised by these means renders it desirable to examine the principles upon which they should be constructed.

Great ingenuity has been displayed in their manufacture, and many complicated contrivances have been employed in the application of the mechanical force. Occasionally considerable demands upon the skill and ingenuity of the mechanist are required; but, as a general rule, elaborate instruments should be avoided. They are often strictly articles of luxury, not obtainable for the treatment of the majority of cases of deformity that present themselves in private, and especially in public, practice. The masters of each department of the art of healing have constantly laboured to simplify the means used. This example should be imitated by the orthopædic practitioner, endeavouring, as far as possible, in the exercise of his art, to be independent of extrinsic aid. The author highly appreciates mechanical apparatus, but can safely add, that when nothing can be effected for the cure of a deformity without a costly instrument, very little can be accomplished with its assistance. In mechanical instruments different applications of mechanical forces are employed,—the lever, the screw, the spring; the last two often resolvable into the lever, screws and springs being often employed to modify or facilitate the action of the lever. In the simplest appa-

ratus, such as the wooden splint or iron stem employed for the straightening of a eurved bone, the middle of the splint is sometimes made to rest upon the prominent point of the bone, as at *a*, whilst by means of suitable straps

Fig. 1.

applied at *b* and *c*, the extremities of the eurved bone are drawn towards the splint, on the same prineiple that a bent stiek is straightened aeross the knee. At other times, as in genu valgum or knoek-knee, and in eurvatures of bones, the ends of the splint or of the iron stem are applied at parts distant from the deformed part. Thus, the ends of the splint (fig. 2), *d* and *e*, are applied, suitably padded, against the troehanter and malleolus externus, whilst by a bandage at *f*, the knee is gradually brought to a proper direction with the shafts of the bones. The foree is similarly applied to a eurved bone (fig. 3).

Again, in the early stage of the meehanieal treatment of talipes varus or elub-foot, the same simple proeess is employed, whether a straight tin or wooden splint be used;

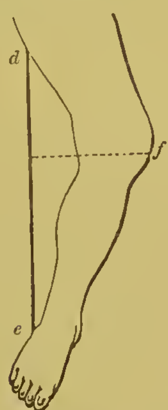


Fig. 2.

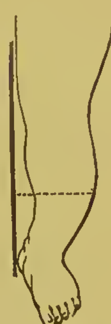


Fig. 3.

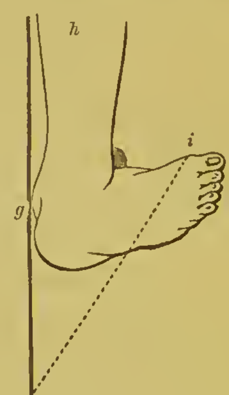


Fig. 4.

the middle of the splint, as at *g*, fig. 4, being applied against the outside of the ankle and tarsus, whilst the upper part of the tibia, *h*, and the toes, *i*, are drawn by straps or bandages towards the ends of the splint.

Even in severe club-foot, requiring more complicated means, and in the advanced stage of the treatment, whilst other objects are simultaneously pursued, the removal of the unnatural curve of the foot and ankle is effected by the steady application of some principle of mechanical power, as in the author's modification of Scarpa's shoe, now commonly used in treatment of varus, and known as "Dr. Little's shoe."

In this apparatus (fig. 5), two springs, *b* and *c*, represent the splint of fig. 4. These two springs meet on outside of the ankle, against which, properly padded, they are applied; the extremities of the springs being brought against the upper part of the leg and the toes, reduce the curve of the dorsum pedis and the altered direction of the ankle-joint, in a manner similar to the action of the splint in fig. 4.

Fig. 5.

In apparatus for rectification of deformities of the spine the mechanical power is applied in the same manner. Thus, in rachitic posterior, and sometimes in angular curvatures, the metal splint or upright, applied longitudinally to the spine, rests against the projecting part of the column, as at *a*, fig. 6, the extremities of the stem being made to act as a double lever above by bands around the shoulders and chest *b*, and below around the pelvis *c*. This contrivance may often be superseded by a common wood, leather, or gutta-percha splint, secured by the ordinary bandage.

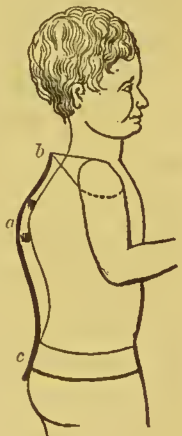


Fig. 6.

In lateral curvature the principle of the lever comes powerfully into operation when its action is understood and properly applied. The majority of apparatus for this deformity are mere *supports*, being entirely deficient in the essential matter which should give

to the apparatus the force of the lever. Thus, Tavernier's lever belt (fig. 7), one of the most simple and scientific combinations for relief of lateral curvature, is comparatively inoperative unless the fulcrum upon which the lever acts is rendered as immovable as practicable upon a movable living body (as at *c*).

Fig. 7.*

The screw in orthopædic apparatus is properly employed as a means of graduating the adjustment to the affected parts, and not as the powerful means its name indicates, of forcing protruded or bent parts into a proper position. The living structures do not with impunity tolerate the brute force of the screw, or indeed of the lever itself. When the apparatus is adjusted to the deformity, the tightening of an additional band, or an additional turn to the screw, brings the apparatus in close contact with the displaced part.

I may adduce the male and female screw in the common splint for bent knee as an illustration of the use of the screw in orthopædy. See Knee ankylosis. This apparatus consists of two splints adjusted to the leg and thigh, connected underneath by the screw in question. The screw is not designed to force the bent knee into a straight position, but is employed for the purpose of varying the angle at which the leg and knee splints are fixed in relation to each other. The work of straightening the limb is effected by a series of straps or bandages by which the limb is secured in the instrument. The most effective of these straps or bandages is that which passes over the contracted joint; and it will

* *a*, metal rod contrived to act as a lever for rectification of lateral curvature; *b*, circular band of covered metal, or of leather, to encircle the hips; *d*, an inelastic band attached in front to the hip-band, and behind to the lever, which, when sufficiently adjusted, tends to replace the lapsed ribs and vertebræ; *c*, a strap passed between the legs, or, still better, beneath the heel, to effect counter-extension.

appear strange to mention that in the majority of knee splints of this description which the author has seen, the principal strap was absent, either through unnecessary fear of pressure over the femur and patella, or through ignorance of the principle on which the apparatus should be applied. In the ordinary ratchet-wheel mode of applying the screw the same explanation applies.

It should be thoroughly borne in mind during the employment of the screw in orthopædic apparatus, that it is available not as a means of forcing the deformed parts into their natural position, but simply as an adjusting contrivance. In any case in which the *force* of the screw is employed, unless for a very brief period, excoriation, sloughing, intolerable pain* in the parts compressed, will inevitably result; the lapsed part should be rather solicited into its place by the more gentle arts of the bandage, than coerced by the unyielding and unfeeling screw.

The metallic spring constitutes an important mechanical power frequently applied in orthopædy. Occasionally its action resolves itself into that of the lever, but is preferable in certain cases on account of greater facility of adjustment, and because its flexibility permits a certain degree of movement in the apparatus, grateful to the patient's feelings. The spring has the further advantage that, wherever applicable, the bandages or straps employed to connect the spring with the part are not required to be so tightly secured as in the application of the inflexible lever. The spring as employed for these purposes is represented in fig. 5.

Springs are often useful adjuncts to other apparatus, for the purpose of neutralising the preponderating action of some muscles, or for assisting the action of those which are

* In some patient individuals vesication, and even small sloughs, may be induced on integuments over projecting bones without complaint of pain,—a powerful reason for anxious examination of a part subjected to pressure. Large sloughs are more than inexcusable.

weak or partially paralysed, and in some cases for wholly supplying the place of a totally paralysed or absent part.

Thus, in partial paralysis of the anterior tibial, the quadratus tibiæ, or of psoæ and iliacus muscles, the spring, applied in many different modes, is often of essential service in raising the toe from the ground, straightening the knee, or in elevating and projecting forwards the femur during the act of walking. Springs composed of caoutchouc or spiral wires are advantageously resorted to to supply the action of the muscles of the calf in paralysis and atony of those parts, upon the same principle that Mr. Gray, the manufacturer of artificial legs, employs them as an ingenious substitute for the same structures.

In this general review of the mechanical means of treating deformities, it is unnecessary to give other examples of the application of the lever, screw, and spring; these will be found under the head of the several deformities.

Gradual elongation of parts, as of the spine, by "extension-beds," and partial suspension by head and neck, have frequently been employed. See also Knee-extension.

A large proportion of mechanical contrivances is included under the head of supports; thus, iron stems, jointed opposite the articulations, are often applied on one or both sides of the lower limbs, as a mere scaffolding to support weakened parts; or when the same are firmly secured around the pelvis, or even higher on the trunk, they are used for the purpose of diminishing the weight of the upper part of the frame borne by the legs. This is effected by the transmission to the ground of a portion of the weight directly through the apparatus, the body being in part suspended as it were upon it. Many forms of spinal apparatus "for the *cure* of lateral curvature" possess no curative properties whatever, are framed upon no principle calculated to counteract the displacing tendency. However much they differ in outward form, by the variation of a screw or two, by the complication arising from the num-

ber of pieces of which they are composed, by the difference in the contrivance of "crutches," by which the removal of the weight of the shoulders is attempted, the majority, either through ignorance of the pathological conditions, the principles of mechanics, or through the difficulty of reducing these principles to practice, act but as mere supports, and possess not the slightest claim to confidence as means of rectifying the deformity. They differ not from a common wooden splint, except in their ingenuity and costliness, their facility of concealment and application, and in their property of mystifying the patient or friends. The principal requisites of every orthopædic apparatus are simplicity, facility of application, and the utmost lightness compatible with the object to be effected. They should not tightly encircle the whole limb or trunk, especially where important nerves and blood-vessels are situated, in order in some instances that the natural movements of the part should be impeded as little as possible, and in others that the circulation of blood and nervous influence be not interrupted. A little reflection will convince the reader what will be the condition of muscles, nerves, and blood-vessels loaded with heavy instruments and circularly compressed, either by iron plates or leather straps. If their use be not discontinued by the patient himself, either through the pain and inconvenience they occasion, and often even, as the author has witnessed, through the large excoriations they have produced, the vessels and nerves being compressed supply the limb with diminished quantity of blood, life, and warmth, the muscles previously weakened by their displacement, or by the forced elongation caused by the deformity, instead of acquiring strength, daily experience a greater loss of tone and bulk.*

An orthopædic apparatus, to be truly useful, should, indeed, be as simple as possible, and like the apparatus for

* The writer has perused no author who has given so practical a view of the objects and effects of mechanical apparatus as Mellet (*Manuel Pratique d'Orthopédie*, 1836), or one whose experience so much accords with his own.

fractured limbs, should compress the limb in its circumference as little as possible, and never tightly encircle it. It should act gradually, *in proportion as the deformity itself gradually changes its form.* It is, moreover, necessary that all orthopædic apparatus be frequently removed and reapplied after a few suitable manipulations, that the persons entrusted with their application continually watch their efforts, and thoroughly understand the manner in which they are intended to act. They must be thoroughly penetrated with the maxim which the author has always endeavoured to inculcate in oral and other teaching, that *arte non vi* is the only mode in which the cure of deformities is worth the accomplishment. They must be prepared opportunely to modify the action of the several parts of the apparatus, and effect by their instrumentality an almost invariable amount of curative or replacing influence.

At the outset of their application the practitioner should be content simply to apply the instrument to the deformity, and not to apply the deformity to the instrument, as is too often attempted by novices in orthopædic practice. In this gentle manner of proceeding, the first difficulty in the treatment of every case of deformity is overcome,—the patient suffers nothing from the attempt to straighten the part; the simple inconvenience of wearing an apparatus, the irksomeness attendant upon necessary confinement of the affected part in an unfamiliar instrument, is his only trouble, and one which is speedily, in a day or two, overcome. Having once applied a well-fitting instrument, the screws or straps by which it is adjusted to the now improving member require to be advanced or tightened as opportunity offers. An impatient advance of the pressure will, by production of pain, and necessity for relaxation of the instrument, occasion loss of time. The principle of action in the progress of mechanical treatment should be that of never advancing too rapidly, so as to risk the necessity of receding. By gentle means, and uniform steady advance, the patient's confidence, so essential to prompt recovery,

remains undiminished. By subjecting the member to no greater pressure than can be easily borne, no temptation to loosening the apparatus is afforded to the timid, and no risk is incurred of occasioning excoriation or inflammation in individuals possessing greater endurance, or in infants, whose cries may be attributed to other causes. In this manner, in suitable cases the opposition afforded to restoration by fasciæ, tendons, ligaments, and ill direction of articular surface, apparently irresistible, may, with the further aid of manipulations, be removed.

In the choice of mechanical apparatus, the surgeon should also be guided by that principle which actuates him in the selection of therapeutic agents in any internal or external disease, viz. the use of that means the action of which he best understands, or in the use of which he has had most experience. A common splint, properly applied, will effect more benefit than an instrument of greater pretension indifferently managed. "He should never lose sight of the circumstance, that, however well constructed and serviceable the apparatus may be, and with whatever care and solicitude he may apply and re-apply it, the recovery of the patient will not be directly due to the instrument, but to the manner in which it is adjusted, and to the numerous modifications made in it during the treatment; modifications which cannot always be foreseen, which may consist of trivial matters, but are sufficient to accelerate the progress of cure. In the cure of a club-foot, for example, however well applied the instrument may have been on the first day, however great the care bestowed in bandaging and manipulations, the instrument, at the expiration of two or three days, will cease to effect any good if continued in the same way; for, if the apparatus has hitherto effected nothing, there is something wrong either in its construction or application; some alteration, perhaps trivial, as of a strap or cushion, is therefore necessary. If, however, the apparatus has produced effects, then its direction and the primitive resistance are changed; the apparatus

consequently must be readjusted. The same thing will recur a day or two later, and so on until the end of the treatment."*

From all these considerations, it is apparent that much harm will result, in the great majority of deformities, from the habit sometimes pursued of keeping a deformed part many weeks in succession in an apparatus without the removal so necessary for the purpose of cleanliness, manipulations, and readjustment. Among the evil consequences of too long retention of instruments, often combined with unsuspected excessive pressure, the author has frequently witnessed excoriations and sloughs, the production of an opposite kind of deformity, as the conversion of varus into valgus, and a degree of rigidity of the part, which has required weeks of painful manipulations and stretchings before the natural movements have been possible,—sometimes indeed entire mobility of an articulation has been rendered impossible. In concluding this subject, the author may add, that in his experience the power and efficacy of suitably contrived and adjusted mechanical apparatus is almost unlimited in the removal of abnormal changes of form, even the more solid parts, as the bones cannot long resist well and continuously applied pressure. The author, confiding in the resources of mechanism, several years since, in consultation with Mr. Allen of Smarden, Kent, advised the attempted restoration, many months after the accident, of a fractured femur badly united, at a right angle, in a lad of good general health, free from *fragilitas* or *mollities ossium*.† The femur was completely straightened, and the limb thoroughly restored. Doubtless a femur fractured many months previously, reunited with deformity, can be straightened with greater facility than a sound femur can be bent; the case in question, notwithstanding, illustrates

* Mellet, opus cit.

† Dupuytren (Sydenham Soc. edit.) thought sixty days the utmost limit within which it is admissible to attempt cure of deformity in callus; Jacquemin three to four months.

how much may be effected in a class of cases usually deemed irremediable after expiration of so long a period.

Forcible Extension, with the aid of Anæsthetics.

Under the head of *manipulations* and stretchings, the value of *gentle* employment of pressure with the hands has been shewn, as a means of curing slight deformities, and as an important auxiliary to other methods of treatment. If a larger measure of pressure or force be used with the hands, the treatment becomes that denominated *violent extension*. Here, as elsewhere, it is difficult to draw an arbitrary line, and say where gentle manipulation ends and violent extension begins. In practice of manipulations the competent operator may frequently avail himself of the smaller degree of sensitiveness displayed by some patients, of the momentary abstraction of the patient's volition from the muscles (a circumstance instantly felt by the hand of the operator), and apply an amount of force which approximates to, or may be considered as, violent extension. But *violent* extension with the hands is rarely efficacious in the removal of considerable contraction and deformity, especially in full-grown persons, because either the pain produced is intolerable, or the voluntary resistance offered by the muscles of the patient exceeds that at the command of the operator; a struggle is maintained between the patient's muscles and the rubber, in which the suffering member is commonly victorious.*

Through the inability of one person to effect, with any effort of his will, an extension forcible enough to overcome severe contraction, violent *sudden* extension, by means of the combined strength of several assistants, or by means of powerful screws, brought suddenly into action, was proposed and carried out, with varying success and misfortune,

* A well-known rubber and instrument maker once informed me, in the most satisfied manner, that he had " broken many a tendo achillis" in children; but added, that he did not " like it."

by Louvrier, Dieffenbach, and others (p. 61). In the less severe cases of deformity, those indeed which are curable by gentler means, without longer duration of treatment, the parts were *suddenly* straightened by violent extension, without ultimately mischievous results, and the expected benefit was obtained. But in severer cases of deformity of many years' existence, in which organic changes of greater magnitude had taken place, as in severe knee-ankylosis, from extensive suppuration about the articulation, with necrosis, violent separation of adhesions, and snapping asunder of bony deposits in the poplitial space and elsewhere, were accompanied with laceration of blood-vessels and nerves, fractures of the bones themselves, and consequent inflammation, suppuration, and even mortification, of the member. The plan was deservedly denounced, and fell into disuse. See Deformity from Ankylosis.

The art of surgery has, however, recently received an invaluable addition to its means of usefulness, by the discovery of the anæsthetic properties of ether and chloroform; and orthopædic practitioners have not been slow in availing themselves of the assistance these means are calculated to render in the cure of deformities. Hence the employment of forcible extension with the aid of chloroform or ether. By chloroformisation, the two great obstacles to the employment of force adequate to straighten or bend a contracted limb, namely, pain and voluntary muscular resistance, are removed. As soon as these impediments disappear, the hands of the single operator, and his single mind, applied to the parts, encounter the physical resistance only of the deformed parts; comparatively gentle manipulations now acquaint him with the nature and amount of difficulty; he can feel his way in the application of greater force; feels and perceives the resistance of parts successively overcome, in an anatomical order; if greater rigidity still oppose, a few movements of the joint backwards and forwards prepare the way for a more extensive yielding; and often the practitioner has the satisfaction of

being able to effect every natural movement of the joint, and satisfy himself that a cure is obtainable.

Chloroformisation, with manipulations, and the use of a certain degree of force, is often of great service as a means of diagnosis; by it the practitioner is enabled to ascertain what proportion of the deformity is due to shortening of soft parts, and how much mischief the articular surfaces may have undergone. He may have reason to conclude, from the amount or nature of the resistance, and the change of articular surfaces, that restoration of the form and functions of the part is impracticable, and thus save much time, which without choroform might have been uselessly expended in an attempt to straighten the part.

After straightening or bending the limb, as the case may have required, by means of this forcible procedure, the part should be lightly secured in a retentive instrument or upon a common splint, adjusted so as to maintain the position more favourable than that which obtained before the operation, though not in the new position, *i.e.* the entirely straight or bent position into which the hands of the surgeon may have brought it. For as soon as the effect of the chloroform upon the sensorial system disappears, the patient will arouse to the conviction of the violence which may have been employed, the part may be acutely painful, and incapable of sustaining the pressure of a tight bandage or ligature.

The author has usually contented himself with the increased knowledge obtained of the nature of the case, with the satisfaction of knowing that the part could be improved in form and function, and that as the resisting parts had once yielded, that they would afterwards oppose less resistance to cure; whether the means subsequently employed should be simple manipulations, the use of mechanical apparatus, or repeated administrations of chloroform, and "forcible extension." The surgeon who should attempt the forcible binding down of a long deformed limb immediately after "forcible extension," would

betray a lamentable ignorance of the pathological condition of the living parts in the immediate vicinity and within the diseased articulation. Although the muscular structures may have yielded under chloroform, and indurated fasciæ and old adhesions may have been overcome by tearing, it will be remembered that much adaptation on the part of nerves, blood-vessels, and absorbents to the altered position of structures needs to be accomplished. The author has found that, by taking moderate means of retaining as much improvement after the forcible extension as can be borne by the sufferer, by unsparing use of lotions of spirits of wine, no inflammation of joints thus straightened has supervened. He has witnessed no untoward accident; and by employing the ordinary means of gradual extension, and repeating once or twice the chloroform, and complete extension whilst the patient lay under its influence, he has restored cases, the relief of which would have required many months of ordinary treatment, or would otherwise have constituted very mediocre cures.

The cases suited for this proceeding are mainly those of partial or suspected complete ankylosis, resulting from former chronic and acute diseases of joints. It is perhaps not superfluous to remark, that the use of "forcible extension" is less defensible in cases of recent disease of articulations than even other active attempts to restore the form in such cases. In a diseased joint the practitioner has to note not only the local disorder, but also the general condition, of which the local affection is but one manifestation. When the surgeon, with ability and experience, has cured the local disorder, *i.e.* removed the inflammation, healed the ulcerated or suppurating parts, or effected subsidence of pain, heat, and tumefaction, the consequences of the diseased action, contracture and rigidity only remaining, he has not necessarily cured, by internal and general therapeutic measures, the morbid constitutional state. This often slumbers after subsidence of local disease, and he should pause ere he too hastily undertake the

restoration of form and movements by forcible extension under chloroform or by other active measures, and thus incautiously evoke renewal of local disorder.

Division with the knife of resisting structures.

This influential adjunct to orthopædy has in some of its details been long practised; as, for example, in division of cicatrices for relief of deformity occasioned by burns, the separation of palmar fascia in deformed fingers and metacarpus from contracture and rigidity of this part, the division of sterno-mastoideus for relief of wry-neck, and in some analogous operations, which fall rather under the province of surgery in general than of orthopædy. More recently (since 1831, the date of Stromeyer's discovery of subcutaneous tenotomy), a gigantie stride in bringing within the domain of cure deformities previously unapproachable by the regular practitioner has been effeeted. Orthopædy is in a position to affirm that few deformities of the members exist, not being amenable to the modes of treatment hitherto detailed, in which partial relief, if not positive restoration, is not procurable with the additional aid of subcutaneous tenotomy. So large and almost universally applicable an addition to the resources of orthopædy has tenotomy proved, that it will form the principal subject in another lecture. The consideration of division of fasciæ is also, for practical convenience, referred to another part.

Electricity.

Electricity in its different forms, electro-magnetism and galvanism, has been much vaunted for the cure of irregular muscular action and the weakness attendant upon many deformities. It is believed by many, from a supposed similarity to the nervous fluid, to be capable of supplying the place of that fluid to the disordered muscles; or it is consi-

dered to act as a stimulus to the nervous centres and the muscular fibres, by which the disengagement of nervous and muscular power becomes excited, and a co-ordination of movements on the part of the muscular fibres and renewed strength in the limb effected. It is much to be desired that any agent could be discovered capable of producing these beneficial results; but experience, which in medicine strips the veil from so many delusions, demonstrates that which morbid anatomy equally indicates, that the more severe and ultimately inveterate cases of paralysis with deformity depend upon organic alterations, in the removal or cure of which electricity effects nothing beneficial; whilst in the less formidable cases of paralysis and contracture, depending upon functional or transient structural changes, electricity is not required for their relief, were it even demonstrated that this agent is always operative for good and never for evil. The confidence entertained by its advocates reposes doubtless upon some facts; no remedy not apparently useful could sustain its reputation beyond a very limited time. The laws of distribution of the electric fluid offer some resemblance to those of the nervous system; hence a prestige in its favour as a means of supplying a deficiency of nervous power in the part or nervous system. Applied to a paralysed part in a certain mode, it commonly produces (involuntary) movements, which are gratefully witnessed by the sufferers as the harbinger of future recovery of voluntary power. *Qui vult decipi decipiatur.* The electricity acts probably as a mechanical stimulus to the muscular fibres, in the same manner as frictions and manipulations, and consequently *may*, in the convalescent case, assist recovery. But the hopes entertained of its ultimate efficacy are soon dispelled, except in these more favourable cases.

The majority of cases of paralysis occurring in early life are independent of organic disease, or result from structural changes—serous or lymph effusions—removable in

time under the influence of recovered general health and suitable hygienic conditions. They do not therefore require the aid of a means of doubtful value. A great responsibility is incurred in denouncing any remedial means; the author considers it his duty to state that he has witnessed several cases of paralysis in children in which, after the use of electricity, improvement has been arrested, whilst wasting has ensued with uncommon rapidity. The action of the electricity upon the part has been manifested by the increased heat and trembling or convulsive movements usually observed in the part during its application. If the agent, powerful as it undoubtedly is, has not ultimately proved beneficial, it may have occasioned the aggravation. The paralysis of childhood, moreover, occurring during a severe illness, is usually at its maximum at the commencement* —at the moment of seizure: such cases either remain stationary, which is rare, or they gradually recover, partially or wholly, in the course of weeks, months, or years. If a case slowly recovering, according to the rule, is suddenly arrested in its improvement, or retrogrades, electricity being in use at the time, whilst other causes of deterioration are apparently absent, it is not unreasonable to apprehend that the electricity has occasioned the mischief. The least that can be stated against electricity in paralysis of childhood is, that it is a potent agent, and one the use of which is not to be disseminated as innocuous and indiscriminately applied in every case of paralysis, which, if recovering slowly, is nevertheless pursuing the normal course of this serious affection.

Retaining Apparatus.

Numerous instances occur in the treatment of deformities in which an apparatus to retain weak or recently

* It is the contrary with the deformity, which is usually augmented in proportion to the duration of the paralysis.

recovered parts is indispensable. These means are most frequently available in the head, spine, and lower extremities. In cases of recently restored articulations, the ligaments and muscles in the previously prominent or lapsed side of the articulations are incapable of supporting the part in its natural direction. Thus, after the restoration of knock-knee, the ligaments and muscles situated on the inner side of the joint having remained for a time lengthened and relaxed, are unable to support the joint and prevent relapse; hence a retentive apparatus, similar in principle to that employed for removal of the deformity, is required. The same observation applies to the necessity of retentive apparatus in the majority of cases of club-foot after operative and mechanical treatment. In successfully conducted treatment, the use of these retentive means should not, in the growing person, require to be prolonged beyond a few months.

It is unnecessary to enter here into details of retentive apparatus required after different deformities; in principle they should correspond with those used to effect the cure; but the principles of lightness, simplicity, and portability require even greater attention. They may consist of springs, to supply the place of wholly paralysed, or to assist the action of partially paralysed muscles; flexible or jointed stems of iron, wood, whalebone, leather, and gutta-percha splints, to maintain the straight line of parts; elastic wire, india-rubber, cotton, and other bandages, to supply the support afforded in health by the tense or elastic fasciæ and cutaneous envelopes.]

I have already defined orthopædy to consist of the art of preventing and correcting deformities, and therefore the principal indications in the employment of therapeutic means may be divided into—1, the preventive; 2, the palliative; 3, the curative.

The means which are simply preventive in one case become palliative in another, and curative in a third. The

value of each will be apparent on reference to their employment in the different classes of deformities. Thus, in inflammation of an articulation, or in paralysis of a member, the practitioner, by proper position, by well-timed manipulations, and by appropriate exercises, endeavours to prevent contraction and deformity; or, aware of the tendency to distortion in young persons of delicate organisation, he employs those medicines that are calculated to increase the vigour of the constitution, and enjoins those habits, postures, and exercises calculated to prevent excassive activity of one part and inactivity of another. In other cases, as in some contractures from paralysis, the practitioner, conscious of the improbability of cure, confines his treatment to palliation of the evil by mechanical elongation of contracted parts, the adaptation of proper instrumental support, and attention to the general health of the individual. In curable cases of each variety, the palliative means may become curative when combined with the internal use of medicines calculated to relieve the state of the internal organs on which the paralysis may have depended.

In rachitic deformities the various means already enumerated, in conjunction with suitable diet and medicines for amending the digestive and assimilating powers, and thereby improving the quality of the circulating fluids, the tone of the nervous, muscular, and other systems, prove essentially *curative.*

On Distortions arising from wounds and diseases of Joints, Accidents, Rheumatism, &c.

I shall now proceed to that first subdivision of our subject, which consists of a class of deformities that are produced by causes operating in a direct manner on the articulations. These causes are injuries and diseases of the joints, the resulting deformities and impairment of

function constituting the partial and complete "ankylosis" of writers. By "ankylosis" is meant stiffness, rigidity, or adhesion of a joint.* The term includes also the existence of distortion, as in the majority of cases the part is fixed in a position which is different from that which is assumed in the quiescent state, and is accompanied with a change of form detracting from the symmetry of the limb. You are aware that ankylosis is divided into false and true, or partial and complete. When described as *partial*, such a degree of impediment to the motions of the joint is implied as materially interferes with its function, but without any union, or with merely membranous adhesion of the articular surfaces. By *complete* ankylosis, on the contrary, is understood a perfect ossific union of the articular surfaces, and consequent incapability of restoration to function.

I shall for a short time occupy you with the manner in which a joint becomes *ankylosed* or *deformed* (for the terms may be almost synonymously employed), before I enter upon the description of the several varieties of deformities we have to consider. A little attention will enable you to perceive that inflammation of the structures around and within the articulations is the sole cause of this class of affections. If we investigate the manner in which stiffness and deformity of a joint have occurred after accidental injury, we find that the immediate effect of the injury was swelling and effusion of the part; or if a joint have become deformed from phlegmon, rheumatism, or scrofula, these constitute but different forms of inflammation; and, however various the progress of each, the mode of production of the deformity will be found very similar.

A more particular examination of the simplest case of inflammation of the knee, which tends to deformity, ren-

* Celsus, lib. v. xviii. 28, states: "ad recenti cicatrice contractos articulos, quas ἀγκύλας Græci nominant, conveniens," &c. Ankylosis has no longer so limited a signification.

ders clearer the manner in which immobility and shortening of parts take place. Suppose an inflammation of the knee from mechanical injury; this is combated by antiphlogistic measures, the knee retaining the bent position. At the expiration of weeks, or even months, according to the general health and the propriety of the treatment, the inflammatory symptoms subside without suppuration or disorganisation; but the previous constitutional disturbance, the debility succeeding to antiphlogistic treatment, and the experience of the exquisite pain and tenderness which existed in the articulation, leave a morbid sensibility in the patient which strongly opposes any attempt to straighten the limb. The inflammation may have subsided without producing disorganisation, but the interstitial lymph has yet to be absorbed (p. 22), some thickening of the tissues exists, the ligaments have not re-acquired their extensibility, the muscles have adapted themselves to the shortened state of repose; and whenever an attempt to straighten the limb is made, or the patient summons resolution to effect the same, the tenderness which is immediately experienced, or the stiffness of the articulation and the feeling of its powerless condition, often occasion procrastination of this important part of the cure. If the practitioner be seconded by the patient, the case proceeds favourably, motion is daily augmented, the tenderness subsides, and the patient recovers. But when fear of reproducing inflammation by passive movements of the limb, or the want of resolution to persevere in restorative measures —frictions and manipulations—have occurred, or when the inflammation of the joint has been very acute or of long duration, and even the patient's life has been endangered by constitutional disturbance, the surgeon feels too happy at having escaped imminent peril, and abandons the limb for a time as a thing of inferior importance. Stiffness or immobility results. The deformity proceeds rapidly on the destruction of the equilibrium in the muscles; and their

retraction may not be arrested until the member is contracted to the full extent of its natural movements, and sometimes even beyond them.

In persons under adult age the angularity of the limb becomes augmented by the proportionally greater elongation of the bones which occurs in a contracted limb during the gradual growth of the frame at that period of life, whilst the contracted state of the soft parts more completely arrests their development.

In these instances of contraction from injury and inflammation of articulations we can study the succession of phenomena which have converted a healthy flexible joint into a rigid immovable deformity. We recognise, in the first place, the direct effect of the inflammation in *stiffening* the soft parts; the swelling of those minute parts of which the extra and intra-articular tissues are composed; and the interstitial deposit of lymph, rendering them incapable of immediately resuming their natural pliability. We perceive that the long-continued rest of the limb in one position is accompanied by shortening of the muscular structures on the contracted side of the member. In the knee, for example, the flexed or semi-flexed position is commonly assumed; hence the continued approximation of the origins and insertions of the flexor muscles induces a gradual shortening of their fibres, in consequence of their unceasing contractility. Their antagonists, the extensors, are proportionately elongated, and ultimately their fibres become weakened. After some time the contraction (of the flexors of the knee in deformity from inflammation of the knee, for example,) attains the maximum, and is succeeded by a change in the muscular fibre, which I have already described under the name of *structural shortening* (p. 13).

When inflammation of articulations is followed by suppuration exterior to the synovial membrane, the granulations by which the cavity of the abscess is obliterated

afterwards constitute tough bands, approaching in density to fibrous tissue. These gradually contract in a manner similar to the contraction that takes place in cutaneous cicatrices, and constitute an additional obstacle to restoring the motions of the joint. The resistance these bands offer will greatly depend on their direction. Should the suppuration have been accompanied with loss of substance, sloughing of the cellular tissue, fascia, or tendons, the tendency to contraction and deformity will be proportionably stronger. Such are the modes in which partial ankylosis and deformities are produced by common inflammation. I have now briefly to consider the influence of scrofulous and rheumatic inflammation.

The strumous forms of disease usually differ from common inflammation in the slowness of their course. The contraction is very gradual; but as the disease affects young subjects, the muscular retraction becomes ultimately as unconquerable as in deformities from ordinary inflammation. The limb is rarely so acutely flexed as after some other causes of deformity, but contraction occurs in the larger proportion of cases. Although suppuration sometimes extends outwardly, accompanied with caries of the bones, it is usually circumscribed, and does not induce the extensive bands of dense adventitious tissue that succeed to the suppuration of acute inflammation. The disorganisation of the ligamentous structures being the common result of this disease, partial luxation of the articular surfaces often occurs, constituting a more complicated kind of deformity.

Arthritic inflammation, under which head I include rheumatism and gout, more frequently induces complete immobility of the joint than any other disease. Greater induration and rigidity of the articular tissues appear to follow this than other inflammations, and considerable proneness to calcareous or ossific deposit around and between the articulating surfaces exists. Contraction and deformity may occur as an immediate result of acute ar-

thritis, or be a sequel of the chronic form of the disease, years elapsing before the calcareous deposit acquires a sufficient amount to render the joint quite immovable. It is worthy of recollection, that the simple induration of the tissues from rheumatism may suffice to produce complete immobility, without the existence of any ossific union, and occasion an erroneous belief in the presence of true ankylosis.

Many of the characters by which a deformity from injury or disease is during lifetime recognised, may be deduced from the preceding observations. The most important is furnished by the history of the case, and by the deformity having immediately succeeded the inflammation. The most prominent symptom is the continued rigidity or immobility of the joint, constituting, respectively, the characteristic practical difference between false and true stiff-joint. The distinction is often very difficult. In either case the rigidity may be so great that no movement of the articular surfaces is perceptible when the patient acts on the muscles of the articulation, or when the endeavour is made, by manipulation, to effect motion of the joint.

The deformity is often the result of displacement of the articular surfaces, but sometimes depends on disproportionate development of the articular extremities, on atrophy of one or more bones, or wasting of the muscles, and is occasionally increased by the indented cicatrices of former abscesses, caries, or necrosis. Shortening of the muscles, tendons, ligaments, and fasciæ situated on the flexed surface of the limb exists in every case of stiff-joint; but the muscular resistance to restoration is most perceptible in false ankylosis.

In complete ankylosis the origins and insertions of the contracted muscles cannot be separated by attempts to move the joint, consequently no tension of their fibres can be mechanically produced; but when incomplete ankylosis exists, although extension be limited, the joint may remain capable of greater flexion, so that the resistance offered by

the muscles is immediately apparent. Even in false ankylosis, where no motion is *visible*, and the absence of *complete* immobility is ascertained only by feeling very slight movements of the articular surfaces, an alternate tension and relaxation of the muscles may be produced by forcible attempts to straighten and bend the limb. Muscular tension is, however, a symptom of ankylosis which may occasion an erroneous diagnosis; as, when absolute immobility of one articulation exists, the patient may be able to act through volition on those muscles which pass over two joints (biceps femoris and gastrocnemii, for ex.), and occasion their alternate contraction and relaxation. As a means of diagnosis, you will observe whether the muscular tension be synchronous with your manual attempts to move the joint. The amount of the resistance to restoration afforded by the fasciæ and ligaments cannot always be ascertained. The tension of those which are situated close to the integuments,—as the fascia lata and the external lateral ligament in the knee, or the palmar fascia in ankylosed fingers,—may be distinguished by the touch; but we can only *conjecture* the degree of rigidity of those that are immediately connected with many articulations, such as the posterior and crucial ligaments of the knee-joint. *See* p. 23 and Contracture.

The *diagnosis of ankylosis* from other affections of the joints is not difficult. It is impossible to mistake, as has been asserted, immobility from *acute inflammation of an articulation* for *stiff-joint;* in the absence of constitutional symptoms, the local tumefaction and effusion, with probably an increase of temperature, would dissipate every doubt.

The distinction of *true* from *false* ankylosis is often difficult. The history of the case may assist your judgment. Where, for example, absolute immobility has succeeded inflammation produced by mechanical violence, you may often conclude that true ankylosis exists. The de-

formity resulting from *white swelling*, on the contrary, is usually incomplete ankylosis. Tact in the examination of such cases will often enable you to detect mobility where none was believed to exist, and to restore a limb that was previously, from its uselessness, regarded as an incumbrance. The pain, or sense of tightness, on the flexed side of the limb produced by manual attempts at straightening, is often an indication of the evidence of some mobility. But a much more delicate test is the production of pain on the opposite side. I should warn you, however, not to consider this test as infallible. Thus, two instances of ankylosis of the knee have come under my notice in which the patella was immovably attached to the tibia by exostosis, or by ossification of the ligamentum patellæ. The attempt to straighten the limb induced pain in front of the knee, either in consequence of the superior edge of the patella being struck against the articular surface of the femur, or through the strain exercised on the adventitious connecting bony matter. In a third case I was unable to distinguish whether the patella was adherent to the femur or the tibia. I have stated that a patient who is affected with true ankylosis will permit examination without apprehension; whereas in *false* ankylosis the individual will mistrust manipulation. This assertion is founded on the circumstance that pain cannot be produced, in one case, by forcible attempts at straightening; and that, in the other, a feeling of weakness in the part exists. Great reliance cannot always be placed on this mode of diagnosis, for some patients labouring under false ankylosis have as little apprehension of examination as those who are affected with true ankylosis, unless they have already been subjected to painful investigation; and a nervous female would be very sensitive to impressions whether she were affected with complete or with incomplete stiff-joint.

I need scarcely mention that you should be quite cer-

tain that no tenderness of the articulation from the previous inflammation remains. A completely ankylosed limb also conveys to the hand of the examiner a sensation of union throughout. The tibia and femur, in true ankylosis of the knee, give the impression of a single bone; and many of the patient's sensations in the limb are referrible to a want of elasticity, which is not absent in false ankylosis, even when no motion is *visible*. Thus, in true ankylosis of the hip or the knee, the patient is more susceptible to shocks that are consequent on any sudden exertion. The whole frame may be jarred by an unexpected false step. This is in great measure obviated by the flexibility of the ankle and powerful action of the gastrocnemii; for, as in ankylosis of the hip or knee, the joint is usually flexed, the patient is compelled to apply the toes only to the ground, and the elasticity of the gastrocnemii may in some degree compensate for the stiffness of the affected joint.*

The prognosis of deformity from causes operating directly on the joints (inflammation and disease) is, in the great majority of instances, favourable. An opinion exists that *true* ankylosis is not uncommon, whereas extended observation shews that it is, comparatively, *very rare*. On the examination of a doubtful case of deformity, it is satisfactory to possess this preliminary information; for although it may lead to error, you may be enabled to undertake with more confidence a case which, but for this circumstance, would be hopeless. *Angular* deformity of a limb is more amenable to treatment than a fixed condition of the limb in a straight line, and is, fortunately, the more common affection.

I shall in my next lecture speak of the *treatment of these deformities.*

* Experience subsequent to the publication of the above views does not enable me to add more certain rules for diagnosis. In obscure cases, examination during anæsthesia is available (p. 43).

LECTURE III.

Treatment of deformities from injury and disease of articulations—Manipulations [with or without the aid of anæsthetics]—Extension by mechanical apparatus—Division of tendons—Contracted hip from disease, with and without luxatiou of femur—True ankylosis of hip—Co-existence of contracture of knee and ankle—Treatment of contracted hip—Section of tendons of the adductor muscles of thigh, rectus femoris, &c.—Value of operation—Contracted knee from injury and disease—Complete and partial knee ankylosis, straight and angular—Treatment of straight knee ankylosis—Prevention of complete ankylosis.

The cure of these deformities (ankyloses) is accomplished by mechanical and chirurgical means, employed singly or conjointly. A large proportion of cases being those in which the rigidity depends on muscular contraction without structural shortening, and with little adhesion of the tissues on the flexed side of the joint, yield to the first class of remedies. The simplest case of stiff-joint is that which, for a few days or weeks, has been immovable after an accidental injury, or from inflammation of the articulation, without its termination in any disorganising process. Popular practice, based on experience, consists in the energetic and sedulous employment of frictions and passive movements, by which the stiffness is gradually removed, volition returns, and the part is restored to activity. In a higher degree of rigidity the use of steam and vapour baths, oleaginous embrocations, fomentations, shampooing, and the application of mechanical instruments are required.

[These means, in many instances, are not rapidly followed by adequate improvement, the obstacle varying in different cases. Occasionally the inherent difficulty of the case, or inappropriateness of the measures adopted, explains

the want of favourable progress; but I have, in consultation, frequently observed that the impediment has resulted from the excessive zeal of the practitioner and of those to whom the functions of rubber, shampooer, and manipulator have been entrusted; too great violence has been employed from the outset; the system of the patient, either naturally morbidly sensitive, or rendered sensitive by the sufferings attendant upon the original disease, has been incapable of supporting the too active efforts made for restoration. In these instances, a gentle and patient application of the same measures has been rewarded with success. In other cases, in which the most favourable means have been recommended, the impediment to cure has proceeded from the imperfect manner in which the manipulations and shampooings have been effected. On recommending these processes in consultation, it not unfrequently happens that the remark is made, that they have been already fruitlessly tried; when, upon inquiry, it is ascertained that the so-called manipulation or shampooing has been a mere surface rubbing of the part, and not the really artistic proceeding required for restoration. Therefore, if the manipulator be found to be ignorant of the rude anatomy and functions of the part, these must be taught him by the medical attendant. Some of the most remarkable instances of successful empirical practice in the treatment of stiff-joints and contractures have been offered by individuals totally unacquainted with the pathology of the cases they have undertaken to treat, but who, possessed of much sound common sense and a few particles of anatomical knowledge, have by manipulations and inunctions achieved the restoration of members regarded as useless, incurable incumbrances by able medical and surgical practitioners.

In cases obviously demanding more energetic proceedings, recourse may be had to the assistance of anæsthetics. Under a state of partial insensibility induced by inhalation of chloroform, a member obstinately resisting ordinary

manipulations may often be made, by only moderately increased application of pressure and to-and-fro movements, to yield to the fullest extent. The confidence inspired by the knowledge obtained that the part was flexible and extensible whilst under the influence of chloroform, induces more successful exertions. Sometimes a moderate amount of chloroformization may be repeated once or oftener ; in other cases, more perfect anæsthesia may be induced for the purpose of diagnosis and prognosis, the skilled hand of the practitioner enabling him accurately to detect the amount and nature of the resistance to cure. I have now and then found it practicable to take advantage of the straightening effected during the use of chloroform to secure the part in a suitable retentive apparatus. Usually, however, in severe cases, the pain experienced in and about the articulations after recovery of consciousness renders the permanent employment of tight ligatures to maintain the part in a new position intolerable (p. 43). I am unable to speak favourably of the employment of sudden forcible, violent extension of a member more or less completely ankylosed during many years, with or without the aid of anæsthetics. The reports circulated these two or three years past to the contrary—of *cures*, in short, by these means of long-standing ankylosis in the course of a day or two—can have no existence in fact.*

The plan of M. Louvrier consists in placing the ankylosed limb, carefully padded, in a mechanical apparatus possessing the powerful properties of the screw; by the sudden and violent action of which, a limb, that may have been many years rigidly ankylosed, is in the course of a few seconds straightened, apparently regardless of rupture of tendons, nerves, and blood-vessels.

* The following extracts from the preface of the author's treatise on *Ankylosis or Stiff-joint* (Longmans, 1843) will explain the nature of the "violent method of extension," originally introduced by Louvrier of Paris, and said to be revived since the discovery of chloroformization.

In Dieffenbach's plan of treating knee-ankylosis, the patient lying on his stomach, and the knee projecting beyond the edge of the table, the resisting tendons are divided subcutaneously; the operator then bends the knee so powerfully as to bring the heel in contact with the nates. He then moves the limb in the opposite direction, and extends it more and more forcibly, occasionally reverting to flexion, and continues this motion of the limb up and down until it is straight. Dieffenbach states* that he has often found the united force of three or four men necessary, particularly in adult cases, "*to break a knee straight.*"

In condemnation of proceedings so dangerous, the animadversions formerly published by the author,† on a similar practice of Sartorius in relation to club-foot, may be consulted. The methods of Louvrier and Dieffenbach are equally inapplicable. Some strictures thereon, contained in a recent review‡ of Dieffenbach's treatise, are entitled to serious perusal by those who may contemplate resorting to this summary mode of proceeding.

* *Ueber die Durchschneidung der Muskeln und Sehnen.* Berlin, 1841.

† *Treatise on Club-Foot and analogous Distortions*, Introduction, p. xlix.

‡ "Louvrier's violence snaps tendons, tears old adhesions, fasciæ, and ligaments, violently stretches when it fails to lacerate nerves or rupture blood-vessels; yet were some or all of these results to take place, provided the skin is not torn and an external wound produced, the patient has a better chance of recovery than when Dieffenbach, in deference to the tendons, divides them with the knife, leaving one or more punctures. We should sooner anticipate laceration of the skin when a puncture, however small, is made, as that may serve as a point from whence a rent may commence, or inflammation, suppuration, and gangrene take their origin. No increased danger can result from Louvrier undertaking to rupture tendons as well as other tissues. The rupture of the tendo achillis is comparatively a trifling accident; and if the rupture of the ham-strings was the limit of Louvrier's violence, we should not so much condemn him: but the danger in reality arises from the injury inflicted on the large nerves and vessels of the popliteal region; and if the *sudden forcible straightening* of the limb be accomplished, this injury must be equally great whether resistance of the tendons has been previously removed by division or not."—*British and Foreign Medical Review*, January 1842, p. 16. W. J. L.

Rupture of the popliteal artery, laceration of the sacro-sciatic nerve and other textures, with the attendant deplorable consequences, occurred in several instances on the application of the sudden forcible straightening by Dieffenbach and Louvrier. These results sufficiently attest the danger of the great degree of violence to which they resorted.

The following pages demonstrate the possibility of straightening every case of *incomplete* angular knee-ankylosis, even after twenty-six years' duration of deformity; it is therefore probable that Dieffenbach's former want of success was attributable to insufficient attention to the mechanical treatment after the section of tendons. A careful comparison of the length of time during which mechanical treatment was required, even in Dieffenbach's successful cases of the application of *the violent sudden method,* with the period of time occupied in the treatment by *the method of gradual extension,* shews that Dieffenbach's plan has not the merit of effecting rapid restoration.

Although in Dieffenbach's successful cases the limbs were by violence suddenly straightened after subcutaneous division of tendons, the resulting inflammation (in some proceeding to suppuration and sloughing of integuments) and constitutional disturbance prevented the proper and continued application of apparatus for the maintenance of the parts in the straight position. This part of the treatment, important to the success of even the violent method, having necessarily been neglected, a strong tendency to recurrence of ankylosis was evinced, requiring, after all, the application of the gradual method of extension. In this manner the entire treatment occupied as long a period as usually suffices to effect restoration by the Stromeyerian plan, viz. subcutaneous tenotomy, succeeded by gradual extension.]

Where the immobility and contraction are considerable

and of long duration, have resisted proper mechanical appliances, and principally or greatly depend on muscular shortening, we may have recourse to section of the tendons of the contracted muscles and ligaments, and of those bands of fascia and adventitious tissue which are within easy reach of the scalpel, followed by the application of appropriate mechanical apparatus, frictions, and manipulations. In the operation, the Stromeyerian method, viz. that of subcutaneous section, should be followed, and the limb be suffered to remain at rest in the deformed position until the small punctures have cicatrised. The limb should then be gradually extended, or flexed, as the case may require; the progress of this part of the treatment being slow or rapid, according to the size of the joint, and the dependence of the resistance to restoration, on the superficial situation, or the depth of the tissues around the articulation. The time requisite to effect a cure varies from one week to six months; occasionally a much longer period elapses before the articulation entirely resumes its functions.

When tenotomy is employed, the combined treatment may be divided into three stages: the section of tendons, the mechanical reduction of the deformity, and the period employed in restoring free movement by passive and active exercises, frictions, manipulations, baths, &c. The first and second stages usually engage but little time; the last, which is commonly the longest in duration, becomes often very tedious.

The treatment requires, even under the most favourable circumstances, great care and perseverance; and its accomplishment in some instances is so tedious and difficult as to discourage those who are not endowed with remarkable patience. I must, therefore, impress upon you the importance of steadily pursuing the means you have selected, so long as gradual amendment in the position of the part is observable. You may, occasionally, after uninterrupted

progress, suddenly meet with an obstacle to further straightening. A careful examination of the member becomes essential; you may discover some fibrous or tendinous band, the section of which may be necessary, or you may detect an insurmountable obstruction to complete restoration in the presence of some osseous or other firm adventitious deposit. The time during which an articulation may have been in part or wholly immovable, and yet be capable of restoration, appears sometimes incredible. The removal of deformity of that most important articulation the knee, which had existed twenty-six years, has been effected. Restoration after ten and fifteen years' loss of the use of an articulation is not uncommon.

True ankylosis, or osseous union of the articular surfaces, having been regarded as a *fortunate termination* of articular disease, has rarely been the subject of curative attempts. The most notable and ingenious of these is the relief, by Dr. Barton of Philadelphia, of true ankylosis of the hip, by sawing through the neck of the femur, and, after obtaining closure of the external wound, resorting to daily movement of the limb, so as to produce, at the ununited parts of the bone, an artificial joint. This operation, in Dr. Barton's case, succeeded perfectly; in the hands of other practitioners, it has been alternately successful and fatal. It is preferable, in my opinion, to that proposed for true ankylosis of the knee by my friend Professor Dieffenbach of Berlin, namely, breaking down the osseous union by chisel and mallet.

[Paulus Ægineta and Celsus had already recommended similar rude and dangerous means for the removal of deformity from redundant callus, p. 40.]

I entertain no doubt of the capability, in some instances, of restoring motion in an articulation between the surfaces of which the deposit of calcareous particles has already commenced. Nevertheless, the risk of reproducing disease will, for the most part, preclude the attempt.

On Deformity from Ankylosis of the Hip.

Inflammation of the hip-joint, acute and chronic, may be induced by cold, mechanical injury—a blow or a fall on the part; or it may be a sequela of typhus, scarlatina, and variola, or other general disturbance of the health. Rheumatism is an occasional cause; but more commonly the inflammation partakes of that specific character which is denominated *strumous*. By whichsoever cause the inflammation is produced, deformity is not an unfrequent termination of it. The most frequent and the most simple form is that of *false ankylosis of the hip, without luxation.* The stiffness or rigidity may be slight, depending only on some thickening of the capsular ligament, and on rigidity of the muscular tissues, from repose of the articulation. Lymph may have been effused into the interior, or upon the exterior of the articulation, constituting unnatural adhesions; suppuration may have proceeded externally, the route of the pus being indicated by firm bands, and cicatrices, which more completely obstruct the motion of the member. Each of the above causes may induce stiffness, immobility, deformity, and lameness, in consequence of the temporary disuse of the joint being attended by structural shortening of the muscles.

Fig. 8.

Incomplete ankylosis from rheumatism.

The *symptoms* are these:—The thigh is rigidly flexed and adducted, and consequently the patient can effect but slight or no involuntary movement of the joint; the trochanter major remains in its natural position; and considerable flattening of the nates, from wasting of the glutæi, exists; with tension of the adductor longus, the adductor brevis, the adductor magnus, the pectineus, rectus femoris, and, occasionally, the sartorius and gracilis

muscles. Little or no motion of the head of the femur in the acetabulum is perceptible on manipulation. With the duration of the ankylosis, the knee becomes more approximated to the abdomen and to the opposite member. The patient applies the toes only to the ground, and walks with considerable lameness.*

* The larger number of cases of hip deformity which have, during the last fifteen years, come under my notice, have resulted from ordinary disease of the hip-joint, which had not been detected during the earliest stage. I have also been consulted in many cases of incipient hip-disease, which have been regarded as cases of "lameness" from a trivial cause, the surgical attendant having failed to attribute the lameness to the right cause. I know not whether the early stage of this complaint more often escapes recognition than the early stage of other and especially internal diseases; but from the frequency with which even good surgeons have overlooked it, I suspect that in some minds uncertainty as to its diagnosis exists. It would be foreign to the subject of deformity to enter fully in this place into the signs by which the earliest stage of hip-disease may be distinguished; I may, however, be permitted briefly to state the result of my experience.

The only forms of "lameness" the symptoms of which in any degree resemble those of *incipient* hip-disease, are, 1, incipient psoas abscess; 2, slight paralysis of some of the muscles of hip and other parts of the lower extremities; 3, spastic affection of hip and other muscles; 4, incipient disease of knee; and 5, certain cases of contracted gastrocnemii.* In all of these cases, some resemblance to incipient hip-disease, as respects the mode of walking, the position of the thigh, and the form of the hip, exists. The cases numbered 4 and 5 may be passed over, as an adequate examination of the knee and ankle joints suffices to shew that the cause of the lameness resides exclusively in those articulations. Cases 2 and 3, although usually presenting some flattening of the nates, with flexion and adduction of thigh,— and 3 presents even a stiffness of the hip similar to the partial immobility of the part in hip-diseases,— may be distinguished by the signs of paralysis or spastic action more or less slight in other parts of the member. Hip-lameness from *incipient* psoas abscess is the only case that may justifiably be confounded with incipient hip-disease; for the disturbed augmented action of the psoæ, which effects a constant drawing up of the thigh, with disuse of the part, consequent flattening of the nates, wasting of the member, prominence of the articulation of hip and trochanter, give a very deceptive appearance of hip-disease, when spinal curvature is not present to account for the psoas disease.

* Congenital luxation of hip should not, in the absence of any history of the case, be confounded with *incipient* hip-disease, for the abnormal position and development of the trochanter, which exist in congenital luxation, are absent in incipient hip-disease.

False ankylosis of the hip, with luxation, comes next in order of description. In many cases the ligaments by which the head and neck of the thigh-bone are attached to the acetabulum become disorganised and loosened; the rim of the acetabulum and part of the head of the femur may have been destroyed by ulceration and caries, and the femur having been thus left to the unresisted action of the muscles of the hip, has become luxated, and is found resting either on the ilium, or in the ischiatic foramen. In either of those situations the process denominated the "formation of a new joint" sometimes ensues; but whether so great natural efforts at reparation take place or not, much rigidity, muscular shortening, and distortion remain.

Fig. 9

Extreme false angular ankylosis of hip.

The *symptoms* of this last-described condition are, rigid flexion and adduction of the thigh, immobility, atrophy, and tension of muscles (greater than in the simple form of false ankylosis), and the trochanter is less prominent, and is situated at a greater distance from the anterior superior spine of the ilium than natural; the thigh is shortened by elevation of the femur upon the dorsum ilii, or upon the edge of the sacro-sciatic foramen, and by the caries or absorption of the head of the bone, producing considerable deformity; the leg and foot are rarely so large as the corresponding parts in the sound limb, their development having been impeded by long rest of the limb during the articular disease which pro-

duced the deformity. The diminution in length of the member, arising from these causes, may vary from half an inch to five inches, locomotion being effected with the assistance of a boot, the sole or heel of which is raised to a proportionate thickness; or the flexion of the thigh may be extreme, and, by preventing the application of the foot to the ground, may compel the patient to use a crutch. See fig. 9.

As for *true ankylosis of the hip*—deformity from complete or osseous union between the articular surfaces,—it so rarely ensues before the age of puberty, and is, consequently, so seldom the subject of consultation, that without the existence, in pathological museums, of preparations demonstrating it, the practitioner might almost doubt its occurrence. True ankylosis may be simple, the head of the femur remaining in the acetabulum, which is uncommon; or it may be compound, the head of the bone being luxated, which is the common form. True simple ankylosis may be *angular* or *straight;* that is, the limb may be fixed either in the flexed or the extended position; whereas in true ankylosis with luxation, it is always *angular*, the limb being fixed in the semi-flexed position.

Symptoms of deformity from *true* ankylosis of the hip, *with luxation*, are, as regards the position and form of the limb, precisely similar to those of false ankylosis with luxation, the difference consisting in the absolute immobility of the thigh. The diagnosis is often extremely difficult; for in false ankylosis,—owing to the great degree of muscular tension and the rigidity arising from deposition of lymph or cicatrices—mobility of the femur can, in some cases, be detected only after repeated examination, and often not until the pelvis has been firmly fixed by an able assistant. The alleviation of the inconvenience of ankylosis of the hip depends on the existence of mobility, however slight; the importance of a correct diagnosis cannot, therefore, be too highly estimated. In some cases

considerable tact and experience in examination are requisite.

In every form of deformity from ankylosis of the hip, *contracture* of the corresponding knee and ankle may coexist; and if the deformity be wholly or partially remediable, the contracture of these parts will require separate treatment.

Treatment. — If, in chronic or acute inflammation of the hip, the practitioner has been so successful that, after a few weeks' or months' duration of the disease resolution has been effected, and slight muscular contraction, with thickening of the articular tissues, alone remains, attention to manipulation, friction and extension of the limb, with cautious exercise, may restore the functions of the member. If the muscular contraction and other resistance cannot be overcome by these means, an apparatus consisting of a circular bandage fastened to the pelvis, and sometimes to the shoulders, with a steel spring [gun-lock or ratchet-screw] attached to the femur, in order to effect extension of the member, may be worn, and will, in a short time, sufficiently remove the contraction to permit the application of the foot to the ground. Or the same object may be attained by lightly bandaging a tin [leather, gutta percha] or wooden splint behind the hip and thigh during a portion of the day, or during the night.* Should the use of apparatus and frictions prove insufficient, the division of the contracted muscles offers a remaining chance of restoration; but that should not be resorted to until the practitioner is satisfied that no risk of reproducing the disease of the hip exists. Thus within the first, second, or third year of the cessation of the hip-joint disease, the attempt at restoration by means of mechanical apparatus will usually be preferable; and if in this manner the mem-

* An instrument is manufactured by Ferguson, Giltspur Street, which effects in a superior manner the triple object of extension, abduction, and rotation outwardly of the thigh.

ber cannot be completely straightened, the aggravation of its position will be prevented. Even when osseous union appears to be imminent, judicious recourse to mechanical means will place the femur in such a position that the deformity will be much diminished, and the member will prove much more serviceable than when, from ignorance of the value of attention to that circumstance, the limb is permitted to remain in the completely flexed position. The section of some of the contracted muscles already enumerated is of value in false ankylosis of the hip, even when many years have elapsed since the original disease began. I have by this means successfully treated adults who had suffered from morbus coxarius in their infancy.

The prognosis must, however, be guarded; for owing to the anatomical conformation of the hip, greater difficulty in ascertaining the precise change which the structures have undergone exists than in similar deformity of many other articulations. Excepting in children, the flexion of the hip cannot be entirely overcome; but if, in older persons, restoration can be so far effected by the aid of tenotomy that, instead of walking with a crutch or crutches, and having the knee drawn up to the abdomen, the thigh can be straightened to the extent of permitting partial application of the foot to the ground, you will be amply rewarded for the attention bestowed on a case of a not very encouraging nature.

I recommend the operation to your attention less as a curative plan than as an important means of amelioration [in extreme cases]. Remember, however, that when you may have satisfactorily performed the section of tendons, the *least difficult* part of the treatment will have been accomplished. In hip cases of deformity, indeed, as in every other, especial attention to the after-treatment is indispensable. Arrange beforehand the means that seem to be necessary for restoring the form and mobility of the part, and, after cicatrisation of the punctures, suffer no delay

in the application of those means. Here is a cast of a late in-patient (fig. 9), aged sixteen years, in whom the limb was elevated to such an extent that the knee almost touched the abdomen, locomotion having been effected on crutches. The ineffectual application of mechanical apparatus in this case induced me to recommend tenotomy, from which sufficient amendment resulted to permit the application of the foot to the ground with the intervention of a sole two inches thick.*

I shall conclude this part of the lecture with two cautions: first, beware of using violence in the after-treatment; secondly, avoid tenotomy, or even active manipulations, until the original disease and any tendency to relapse have completely subsided.

I now proceed to the subject of

Contracted Knee, from Inflammation or Disease of the Articulation.

The great size of the articulation of the knee, the large amount of lowly-organised fibrous tissue entering into its composition, the absence of warm muscular coverings, such as are present in the shoulder and hip-joints, and its consequent greater exposure to changes of temperature, its distance from the central organ of the circulation, and the dependent position of the lower extremity, together with its liability to accidental injury, explain its susceptibility to disease. The knee is, in fact, more obnoxious to the destructive influences of scrofulous, rheumatic, and other

* Having met with several cases of complete straight hip ankylosis, and noticed the comparatively greater facility of locomotion possessed in such cases than when complete ankylosis occurs in the extremely flexed position, as at fig. 9, I have formed the opinion that it would be safe, practicable, and advantageous, in *angular* hip ankylosis, to divide the femur near to the pelvis, and by gradual depression of the thigh obtain union of the bones at such an angle as would suffice for application of the entire sole to the ground. Shortening of the limb would require the compensation of a raised shoe.

inflammations, than any other articulation of the frame, and consequently the contraction and deformity denominated stiff-joint is of frequent occurrence in this situation.

Knee ankylosis may be of two kinds; complete or osseous, and partial or membranous. The former, being insusceptible of any relief, except when the calcareous spiculæ are very few, need not detain us long. Greater importance attaches to the consideration of the means of distinguishing true from false ankylosis.

Little or no deformity accompanies partial straight ankylosis of the knee, except that arising from imperfect development or wasting of the muscles of the thigh. These offer occasionally a strong contrast with the powerful mass of the gastrocnemii, the energy and growth of which have been excited by the increased demands on their activity consequent on the stiffness of the knee. The leg commonly presents slight rotation outwardly, the toes being everted. In the act of walking, therefore, the foot more easily avoids inequalities on the surface of the ground.

Straight partial ankylosis of knee is sometimes the result of imperfect cure of angular ankylosis, extension having been accomplished, but the joint remaining incapable of flexion. You may, therefore, be consulted in a case of rigid immovable knee in the straight position, and be required to consider the propriety and possibility of restoring the natural movement. You will reflect on the probable nature of the obstruction; you will endeavour to ascertain whether it arise from adhesions resulting from effusion of lymph among the extra-articular tissues, whether from bands of adventitious matter, the product of cicatrised abscesses, or from membranous and calcareous adhesions of the opposing articular surfaces. You will refer to your knowledge of morbid anatomy derivable from anatomical museums; and remember the possibility of bony matter being deposited in the posterior part of the joint, in the situation of the crucial ligament, or perhaps the

patella being ossified to the femur, so as to restrain the movement. When satisfied of the existence of mobility, however slight, especially when the resistance is of an *elastic* nature, you will employ the general therapeutic measures described whilst treating of deformities from ankylosis in general,—frictions, manipulations, bathing,—and for mechanical means select one of the forms of apparatus I shall recommend for reduction of angular deformity, the action of the instrument being of course reversed when you desire to bend the articulation. I have not found the aid of tenotomy requisite in the remediable cases of a straight stiff knee that have fallen under my observation. Although this deformity does not prevent application of the foot to the ground, it occasions great inconvenience in walking upon an uneven surface, or ascending a hill or staircase. The great flexibility of the ankle, to a certain extent, relieves the discomfort; but the limb being, from the inflexibility of its most important joint, rendered relatively too long, it is felt continually *in the way*,—patients eagerly embrace the hope of obtaining a slight amount of flexion; and this may, in the majority of instances, be obtained by perseverance in the methods above mentioned.

I may add a few remarks here on the prevention of ankylosis and deformity. Many cases will present themselves, in which, after inflammation, either of a phlegmonous or a rheumatic character, and incipient calcareous deposit, attention may be usefully directed to attaining a more favourable position of the member, and to the retention of a limited amount of mobility. Bear in mind that a slightly flexed knee is preferable to an absolutely straight one, and that even mobility to the extent of a few degrees will greatly ameliorate the patient's condition.* Surgeons entertain well-founded objections to the

* The author has here omitted a paragraph in which interference with incipient ossification was recommended (p. 64).

movement of a recently inflamed articulation as a means of preventing stiff-joint, the danger of reproducing disease being, in incautious hands, great; but too limited a view of the nature of the previous disease, and exaggerated fears of the danger of relapse, often indispose the practitioner to attempt restorative measures. Remember, however, that most local inflammatory affections require for their production and maintenance a morbid condition of the general frame, and that, during the continuance of the local disease, a beneficial change in the general health often ensues; so that those means which, at one stage of the affection, would have been ruinous to the articulation, may at another be safely applied. The general health should constitute an important guide in the endeavour to restore flexibility to a partially ankylosed limb. After severe inflammation of a joint, which has not terminated by resolution, but by one or other of the "terminations of inflammation," the system having been depleted, or the morbid predisposition removed [by time], by proper regimen, or by antiphlogistic and other remedial agents, we may usually, within a few months, endeavour to remove the resulting rigidity; but after strumous disease of an articulation it is prudent to wait a longer period, or until a favourable change in the diathesis of the individual has taken place. Sometimes, in such cases, we may be compelled to wait even several years before attempting to restore the usefulness of the member.

LECTURE IV.

Contracted knee from disease, or angular knee ankylosis — Varieties — Mode of distinguishing remediable from irremediable cases — Complication of contraction of knee with displacement of articular surfaces — Treatment: mechanical means; section of ham-strings, &c.

Angular contraction and deformity of the knee (false angular ankylosis) is the more frequent result of disease of the articulation, and presents itself in numerous grades of severity. The articulation may, from the previous disease, have undergone the smallest appreciable injury in structure and function; or the greatest amount of disorganisation,

Figs. 10 *and* 11.

Front and lateral views of knee-ankylosis from chronic (scrofulous) disease, excited by general debility consequent on an attack of fever.

ulceration, adhesions, cicatrices, and luxation, compatible with remaining motion, may exist. The contraction may vary from a few degrees, the sole being scarcely raised from the ground (figs. 10 and 11); or it may be so considerable that the heel almost touches the nates (fig. 12). Locomotion is frequently in such cases impossible, excepting with the aid of a crutch and stick, or a raised shoe.

Fig. 12.

Incomplete angular ankytosis of knee from phlegmonous erysipelas of entire timb, completely straightened and restored to active usefulness after section of ham-strings, &c.

The muscular shortening corresponds with the contraction. The tendons of the biceps and semi-membranosus and semi-tendinosus muscles are tense when extension is attempted. Sometimes the biceps appears alone contracted; but, in such cases, section of the inner ham-strings is usually necessary to complete the restoration. In false angular ankylosis of many years' duration, the lower portion of the vastus externus, and the portion of the fascia lata with which it is connected, and even the sartorius and gracilis tendons, are much contracted.

Emaciation and wasting of the bones accompany every [long-standing] case of angular knee-ankylosis. Occasionally, some contraction of the gastrocnemii, and other pos-

terior muscles of the leg, coexists. The degree of motion remaining is variable; in some cases in which the contraction habitually amounts to 70° or 90°, the limb admits of slow extension by pressure, and reduction of the contraction 20° or 30°. The kind of resistance felt on attempting to make extension may be termed elastic. Sometimes free motion within a limited range exists, a sudden stop to further movement being perceptible. Occasionally the knee cannot be extended beyond a right angle, but freely admits flexion, so that the heel may be approximated to the nates. In many cases, however, there is no perceptible flexion or extension, the joint being truly stiff: here the question of the existence of true ankylosis arises. The absence of osseous union between the tibia and femur, or between the patella and either of those bones, can only be determined by the most accurate investigation. If the patella be free, or merely united by membranous or ligamentous tissues, some slight motion on its perpendicular axis may be discovered; one of its edges, more commonly the inner, may be depressed. A slight movement of the edges of the tibia and femur where they are applied to each other may sometimes be felt.

In addition to these means, you will observe whether, on endeavouring to extend the limb, the ham-string muscles be rendered tense. Caution is necessary when resorting to this source of diagnosis, lest the voluntary tension of the muscles by the patient be mistaken for that maintained by the attempt to straighten the limb. The patient's mind should be diverted during the examination; and you should observe whether the tension and relaxation of the tendons be really produced by the alternate extension and relaxation of the limb effected by your hand. I have already alluded to the production of pain on the contracted and uncontracted sides of the member, and the relative value of the information derived therefrom (Lecture II., p. 55). The external configuration of the knee in angular ankylosis varies; the joint may be rigidly flexed,

the form not differing from that of the sound knee similarly flexed. This often occurs in cases resulting from phlegmon affecting the entire limb (as at fig. 12), or after rheumatic inflammation of the joint; whereas, in other instances, especially after strumous and other forms of synovitis, in which softening and disorganisation of ligaments have taken place, the muscles have not simply contracted the articulation, but they have likewise altered the relation of the articular surfaces, and occasioned partial luxation and deformity, as in these models (figs. 10 and 11).

Fig. 13.

f, fibula; *t*, tibia presenting outwardly; *p*, patella; *a*, adhesions.

The displacement invariably consists of a dragging backward of the head of the tibia from the anterior and inferior part of the articulating surface of the condyles of the femur by the continued action of the ham-string muscles, and is increased by the rotation outwardly of the head of the tibia, effected by the more powerful action of the biceps, favoured probably by the peculiar arrangement of the crucial ligaments, and sometimes by the patient, during the articular disease, having reclined on the back whilst the limb was placed on the outer side. This outward rotation of the tibia is accompanied with eversion of the leg. The patella and its ligament are abnormally

placed on the external condyle (*e c*, *e c*, fig. 13). The conjoint phenomenon of displacement, rotation, and eversion of tibia exists in different degrees; it may be slight, or almost complete dislocation of the tibia may be present, and even the anterior surface of the tibia may be applied to the posterior part of the femoral condyles, and the utmost deformity result, as in this model (fig. 14).

Fig. 14.

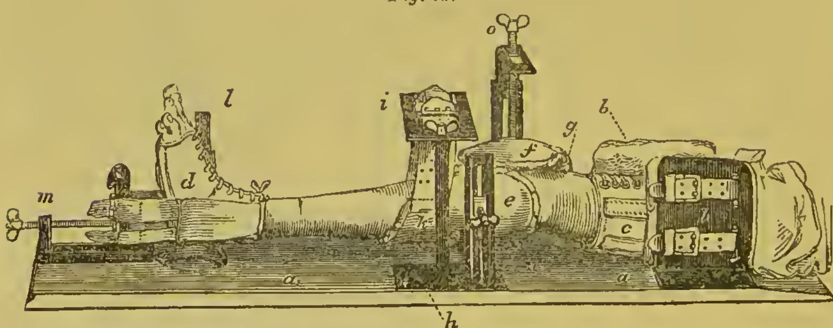
Angular incomplete knee-ankylosis from white swelling.

The great majority of cases of false ankylosis of the knee are unaccompanied with pain. If, therefore, pain be constantly present, or if, after exercise, some part of the articulation be painful, particularly if the case be not complicated with displacement, we may suspect that the original disease of the articulation has not subsided. But if displacement exist, and pain on the inner side of the articulation be experienced only after unusual exertion, and it subside after moderate rest, without application of remedies, we may infer that it is merely the result of an undue straining of the ligamentous structures of the part, consequent on the weight of the body being inefficiently borne by the contracted limb, and its having a tendency gradually to produce a further displacement.

Treatment of angular knee-ankylosis.—When, from the existence of mobility, the absence of disease of the articulation, or other insuperable obstacle, you may have determined the remediableness of a case of false ankylosis, you will then decide on the propriety of confiding to mechanical means, or of resorting to surgical operations. I have already, in the remarks on the treatment of ankylosis, indicated the principles on which the treatment should be

conducted. The apparatus which I have found serviceable under such circumstances is a common splint, bandaged on the contracted side of the articulation during the intervals of the manipulations, frictions, and baths; or if the flexion of the limb prevent the application of a perfectly straight splint, each of a series of tin splints, at different angles, may be successively employed, until the limb is perfectly straightened. A very common and excellent contrivance consists of two wooden or metal splints, adapted to the posterior surface of the thigh and leg, connected behind by an ordinary male and female screw [or laterally by a ratchet-wheel], by means of which the joint may be gradually extended, or [in extreme cases] the more complex apparatus (fig. 15 or 16) may be used.

Fig. 15.

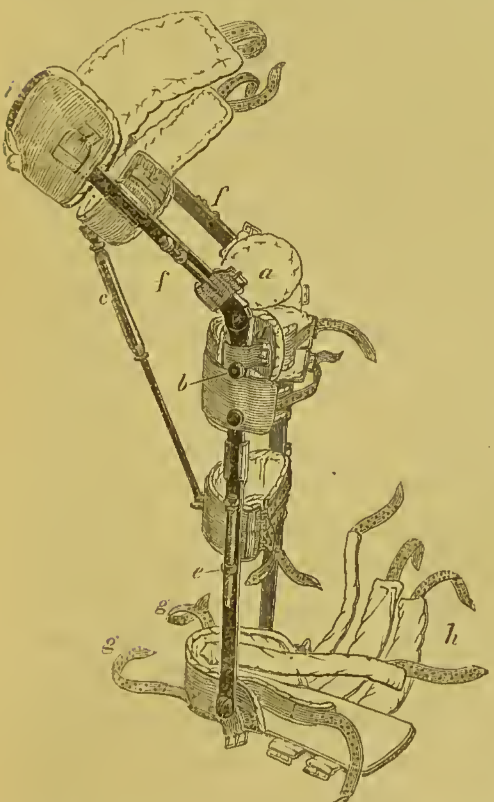


It consists of *a a*, mahogany board; *b b*, movable padded metal pieces, and *c*, laced circular bandage, serving to encase and fix the thigh and pelvis; *d*, laced stocking and straps, secured to the screw *m*, constituting the means by which the foot is drawn downwards, and the articular extremities of knee drawn asunder; *f*, concave pad, serving, through the agency of *o*, to press down the knee; *e*, movable pad, attached to a movable screw, adapted so as to press the fibula and tibia inwardly; *g*, similar pad, to press the internal condyle outwardly; *h*, one of a pair of uprights, on which rests transverse piece *i*, serving as a bridge, from which, by means of the strap *k*, the upper portion of the tibia is elevated; *l*, a spring, the action of which inverts the foot, and combined with *m*, inverts the leg.*

* See value of gentle mode of proceeding, pp. 38, 39, especially applicable during the employment of powerful apparatus.

When, however, the rigidity is very considerable, the deformity having existed during several years, and mechanical means offer no prospect of cure, the propriety of resorting to tenotomy should be considered. The parts that may require division are the tendons of the biceps, semi-membranosus, semi-tendinosus muscles, the lower por-

Fig. 16.



Apparatus for effecting extension of the knee. It consists of a firm steel bar, extending, on both sides of the limb, from pelvis to the sole, with joints at knee and ankle, the thigh and leg pieces being capable of elongation by means of the sliding pieces and screws *f f*, *e e*. The part *i* indicates the padded upper extremity of the apparatus, adapted for pressure against pelvis; *g g*, straps to which an ankle-piece may be secured for the purpose of holding down the heel; *h*, series of straps, intended to secure foot in shoe; *c*, an ordinary male and female screw, by turning of which straightening of the knee is effected; *d*, concave pad, which, by turning the screw *b*, may be made to press the upper part of the fibula and tibia inwardly; *a*, similar pad, which, by the action of a screw on corresponding side of apparatus, effects pressure against the internal condyle. When the affected limb is properly secured, the articular extremities of femur and tibia may be separated as described page 85, by the gradual operation of the screws *f f*, *e e*. A padded knee-cap, to prevent elevation of the knee, completes the apparatus.*

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* Where only a moderate resistance has to be overcome, the extension may be effected by a ratchet-wheel action instead of the male and female screw.

tion of the fibres of the vastus externus muscle, and the fascia above it; and some bands of fascia in the popliteal region do not escape division. Occasionally, section of the sartorius and gracilis tendons will assist the restoration of the limb. The necessity of each or all of these sections should be determined from the existence of such an amount of tension in each of the tissues as would greatly or insuperably oppose mechanical elongation.*

Should an old, firm, indented cicatrix appear, by its adhesion to the bone beneath, to be capable of offering resistance to the extension of the limb, its deeper attachment may, if practicable, be *subcutaneously* divided.

The operation, when properly conducted, is followed by no pain or febrile disturbance; the punctures cicatrise on the third or fourth day, being a day or two later than when tenotomy is practised in the foot, probably in consequence of the greater laxity and abundance of the cellular tissue in the popliteal region.

[The method of dividing the ham-string tendons is very simple. The patient should be placed in the prone position, and the limb firmly extended by an assistant, in order to render the parts sufficiently tense. The tenotome should be introduced *flatly* through the integuments on the internal edge of the tendon to be divided as deeply as may appear needful for passing around it. When the instrument is known to be situated between the tendon and the more deeply seated structures, the edge should be turned towards the tendon; cutting it, therefore, in a direction from the deeper structures of the limb towards the surface. As the outer ham-string is often more tense than the inner, it will usually be found advantageous to commence with the biceps, and proceed afterwards to the semimembranosus and tendinosus; for the division of the biceps

* I have here omitted some observations which tended to justify divisions of superficial nervous filaments in the ham; a proceeding which later experience does not sanction.

causes the remaining muscles to become more prominent. Occasionally, in stout subjects, it may appear difficult to define the exact outline of the tendon, and the spot where the knife is to be inserted. In such cases we may bring the tendon momentarily to the surface by requesting the patient to try to bend the knee. With these precautions, no danger of wounding other parts exists. The external branch of the popliteal nerve has sometimes suffered injury, probably through the section of the biceps having been performed too near its insertion, or from the operation having been too boldly performed. When free mobility of the joint within even a limited range exists, it is right after the operation to apply either to the posterior or lateral aspect of the knee a splint suitably bent or adjusted, with the view of preventing movement of the severed parts. If, however, the part be immovable by ordinary handling, or by moderate pressure, the splint is superfluous.]

No violent attempt to effect immediate reduction of the ankylosis should be made; and it is important to await complete cicatrisation of the punctures before the application of extending apparatus. Neglect of this precaution may separate the agglutinated puncture, lacerate the cellular tissue of the ham before it is perfectly cicatrised, and by providing a spot for the commencement of suppuration, occasion a considerable abscess among the structures of this important region; whereas I have never witnessed the slightest delay in the cicatrisation, the most trifling blush of inflammation, or one drop of pus, where rest of the limb has been scrupulously enjoined.

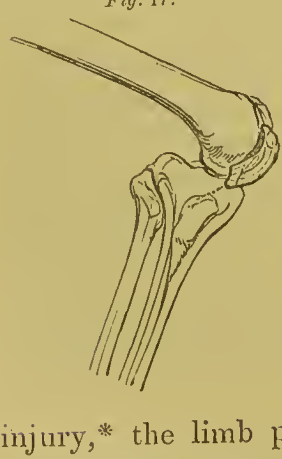
On union of the punctures, the more important portion of the treatment, the gradual removal of the deformity, may be commenced.

LECTURE V.

Replacement of articular surfaces in angular knee-ankylosis—Knee-extending instruments—Restoration of movements in the joints—The advantage of tenotomy—Complete immobility of ankle—Deformity of the ankle from injury, scrofula, and rheumatism, resembling talipes equinus, varus, and valgus—Mode of performing section of tendo-Achillis, &c.

In *false ankylosis of the knee, without displacement,* the simplest apparatus (p. 80) may suffice; but when displacement and rotation of the head of the tibia, with eversion of the leg exist, a better adaptation of mechanical powers to the exigencies of the case is required. The objects to be attained are, 1, extension of the knee; 2, the carrying forwards, and sometimes inwards, of the head of the tibia; 3, simultaneous inversion of the leg. I have ascertained, from repeated experience, that when attention has been directed to remove the abnormal flexion only, an increased displacement of the head of the tibia sometimes resulted. Thus, supposing the relation of the tibia and femur to have been prior to the operation, as represented in the annexed diagram (fig. 17), the effect of simply extending the limb will be to change the position of the bones, as in fig. 18, the leg having been extended, but the displacement being undiminished. I have in such a case found the luxation complete, and the extremities of the bones as moveable as in a recent luxation from injury,* the limb presenting to the eye of the surprised

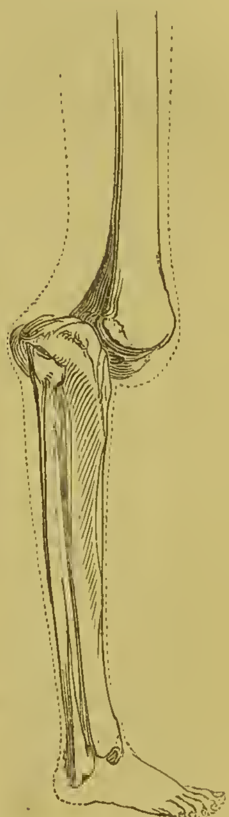
Fig. 17.



* An "accident" from twisting by machinery, which the author once witnessed whilst dresser at the London Hospital.

attendant an appearance of greater deformity and weakness than before the commencement of his well-intentioned but injudicious management. In a common knee-extending apparatus no contrivance is present to facilitate the gliding of the bones into their proper position; on the contrary, the pressure necessarily exercised on the head of the femur during the extension forcibly urges the bones against each other. The method of obviating this imperfection in extending apparatus consists in employing the pelvis as a fixed point, and, by making extension from the ankle and foot, so to draw down the entire limb as will not only *extend* it, but elongate the ligaments of the joint, and other structures exterior to it, to such an extent as will enable the tibia to rise into its position. By this elongation the painful pressure of the femur and tibia against each other is completely avoided. When the ends of the bones are presumed to be held asunder, pressure on the upper and inner surface of the condyles, and on the upper and outer surface of the tibia and fibula, will essentially promote their reposition. The eversion of the leg and foot is overcome by gradually drawing the malleoli inwardly, simultaneously with the more important process of reducing the luxation. The utmost caution is requisite during extension to protect the point of the knee and heel from undue pressure, as excoriations or sloughs in these situations may entirely frustrate the operation.

Fig. 18.



As after tenotomy the limb will generally yield readily to a considerable extent, a common knee-extending instrument may be applied during a week or a fortnight. This partial restoration will prepare the limb for the more diffi-

cult part of the process, for which I recommend the apparatus that is now before you (figs. 15 and 16).

On completing the extension and replacement of the knee, the joint is usually found to be very stiff in its new position [unless this result has been averted by well-timed manipulations (p. 26)]; your next object may therefore be to restore its movements, which is often more difficult than the previous part of the treatment. Passive movements should be diligently practised several times daily, or as often as the tender state of the articulation will permit; together with frictions, vapour-baths, and the application at intervals of the extending apparatus, its action being reversed in order to produce flexion. It occasionally happens that, with the utmost exertion, the knee cannot be bent to the extent of the previous abnormal flexion. Exercise may be permitted as soon as the limb is straightened; but in the majority of instances, a firm mechanical support, as an ordinary *iron* on the outside of the limb, with a spring to assist the motion of the weak extensor muscles of the knee, will be necessary for weeks or months afterwards, according to the severity of the case. A laced knee-cap may be subsequently substituted for this support.

The average length of time occupied in the straightening and reduction of the displacement of articular surfaces after the operation, in adults, is two months; in children the success is more rapid. The process of restoring mobility, without which the individual continues to walk lamely, is seldom completed in severe cases within a period varying from three to six months, at the expiration of which time the patient usually walks long distances in comparative comfort. If the articulation continue very tender, or the deformity have existed during many years, twelve months or more may elapse before the patient can be considered fully restored.

Should the case have been unusually complicated, as from adhesion of the patella, or should the permanently abnormal position of that bone on the upper and outer

part of the external condyle prevent action of the extensor muscles, the restoration of the knee may appear to be very imperfect. If it, however, be straight, and if the femur be fairly in apposition with the tibia, and the joint admit of motion in a range varying from 20° to 40°, the patient will be able, without artificial aid, to walk long distances with perfect ease, and will be very grateful for the change in his condition.

No class of deformity better illustrates the advantage of the Stromeyerian operation for the relief of deformities; for although the relief afforded by this method, when properly conducted in cases of club-foot, may appear to be more complete (as not only the form but the mobility of the ankle and the development of the muscles will be more nearly perfect), yet the consideration of the comparatively greater importance and size of the knee-articulation, the circumstance that angular deformity of that joint necessarily impairs the functions of the corresponding ankle, together with the greater amount of lameness attendant on contracted knee than on club-foot, will suffice to shew that *relief of knee-ankylosis* by *tenotomy* is as great an addition to the healing art as that of club-foot. *White-swelling*, for example, popularly regarded with horror, is indeed divested of its terrors, when it is considered how rarely, in the present day, owing to the improved mode of treating the disease in its earlier stages, amputation is adopted; and that, notwithstanding that this disease is peculiarly prone to terminate in deformity, it constitutes the most favourable form for dividing tendons, the subsequent mechanical treatment being more easy, and the restoration of the limb more complete, than in ankylosis from rheumatism, or from extensive suppuration from phlegmon.

Complete immobility (true ankylosis) *of the ankle* is uncommon, and need not detain us long. If the foot, although immovable, be flexed to a right angle, so that the entire sole be applied to the ground, locomotion may be readily effected, and the assistance of art be unnecessary. Incon-

venience is, however, sometimes experienced from the entire weight of the body being borne by the heel, and consequent transmission of shocks through the necessarily extended knee to the spinal column and its contents. This may be obviated by recommending the patient to wear a shoe with the heel sufficiently elevated to produce a small amount of flexion of the knee, and thus interrupt the continuous straight line through which the shock is communicated to the frame.

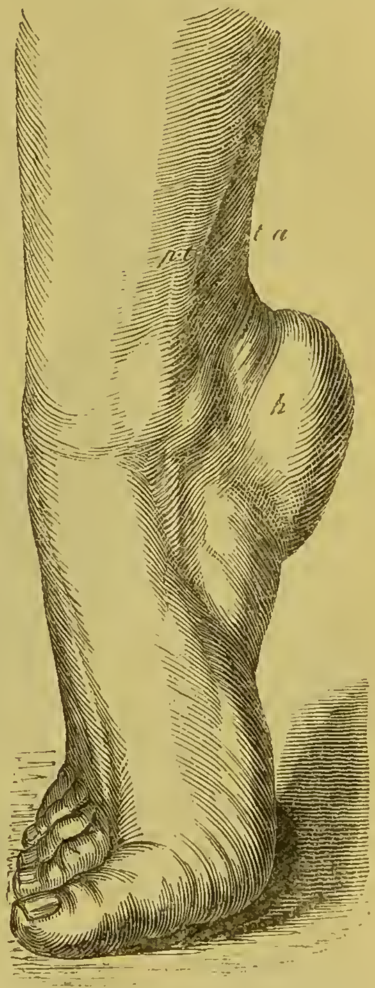
Deformity with incomplete ankylosis of ankle.—The more frequent form of this affection results from strumous inflammation of the bones entering into the composition of the ankle-joint. You will find that in such cases the disease usually commenced in the lower extremity of the fibula and adjacent parts of the astragalus and os calcis, succeeded by suppuration and caries. The ankle-joint is weakened by the degeneration of the osseous and ligamentous structures which should support it on its external aspect, the patient is inclined to tread on the inner edge of the foot, and the peronei muscles being henceforward relaxed, gradually contract and elevate the outer edge of the foot. The progress of the disease is usually slow, several months, or two, three, or more years, elapsing before the ulcers completely heal. Cicatrisation is accompanied with the deposit of adventitious tissue beneath the skin in the tract of the previous suppuration. This abnormal tissue constitutes firm bands of adhe-

Fig. 19.

Deformity of ankle from articular disease resembling talipes equino-valgus, characterised by elevation of the heel and eversion of the toes.

sions, connecting the eroded or carious extremity of the fibula with the astragalus and os calcis; and by the occurrence of that contraction in its fibres which is peculiar to newly-formed tissue, the elevation of the outer edge of the foot is augmented. Increase of deformity rapidly follows the disturbance of the equilibrium of the muscles. The peronei so completely obtain the preponderance, that a considerable eversion of the toe is added to the elevation of the outer margin of the foot. The heel is elevated by contraction of the gastrocnemii. (See fig. 19.)

Fig. 20.



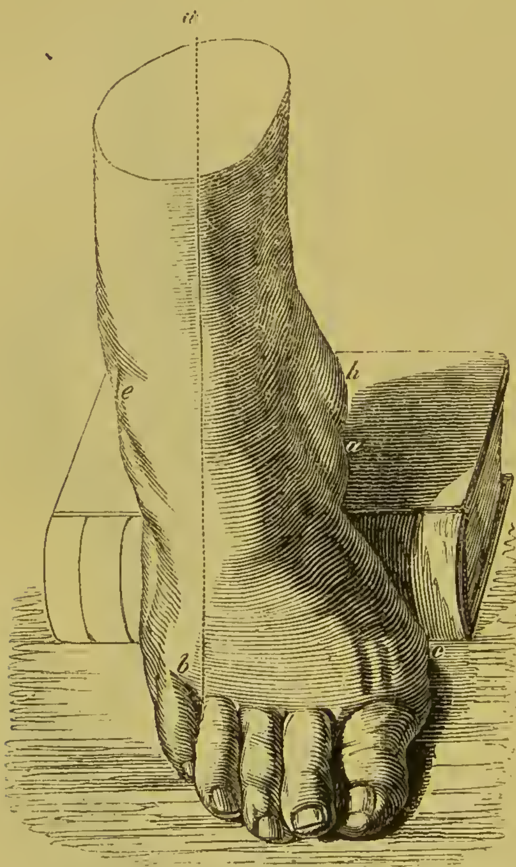
Deformity of ankle from articular disease resembling talipes equinus.

Rheumatic inflammation of the foot may induce immobility and a similar contraction with deformity. But if the rheumatism do not especially affect the synovial membrane; but through the continuance of chronic inflammation in the muscles, tendons, ligaments, and fasciæ, on the posterior and internal aspect of the ankle, and particularly in the sole, it induce so great atony in their fibres as will permit a sinking of the tarsal arch, a kind of flat foot results. Eversion of the toes, and stiffness of the tibio-tarsal articulation, causing the individual to walk on the inner margin of the foot, accompany the deformity. Vide Flat-foot.

Deformity of the ankle from disease of the leg-bones may likewise occur in the extended position (fig. 20), si-

milar to talipes equinus. Here also is the model of a foot which had been contracted for twenty years in the form of talipes equino-varus (fig. 21).

Fig. 21.



Deformity of ankle from disease of leg and tarsal bones in the form of equino-varus (elevation of heel with inversion of fore part of toot). The perpendicular line *a b*, passing through the axis of the leg, shews the inward inclination of the anterior part of the foot, the little toe being alone situated on the outside of that line. The patient, therefore, chiefly walked on the ball of the little toe: *c*, prominent metatarsal joint of great toe; *h*, heel; *e*, projecting edge of articulating surface of astragalus; *a*, contracted abductor pollicis, which had approximated the great toe and heel.

In this instance the foot is not simply extended through contraction of the gastrocnemii, but the toes are inverted from shortening of the adductor muscles and of internal ligaments of ankle, assisted by contraction of cicatrices.

I have met with a perfectly similar deformity from fracture of fibula and injury to ankle-joint. You will experience no difficulty in distinguishing deformity of the ankle caused by disease or accident from similar changes in the form and position of the part, such as club-foot, and paralytic and spasmodic deformities. The history of the case, the nature of the stiffness, the dependence of the muscular contraction on causes primarily affecting the structures composing the articulation, will determine the diagnosis.

In each of the forms of deformity of the ankle which I have described, the rigidity of the articulation, whether resulting from adhesions within or without the capsular ligament, or from the consecutive muscular contraction, may be so considerable that scarcely any mobility of the bones entering into the composition of the articulation may be perceptible; thus, an opinion of the curability may depend on the detection (whilst manipulating the limb) of slight alternate tension and relaxation in the tendons of the contracted muscles.

The amount of lameness arising from these affections is often very considerable, and the inconvenience and pain experienced by the individual are usually greater than might be believed to exist. The circumstance which, in addition to the pain and discomfort attendant on locomotion with a stiff ankle-joint, occasions a ready application for relief, is the constant tendency evinced in the severer forms to increased lameness and deformity, consequent on the disturbance of the equilibrium of the muscles, and on the weight of the body being transmitted to the astragalus, whilst this bone is not situated horizontally beneath the axis of the limb, so as properly to communicate the weight through the tarsal arch to the ground. The portion of integument on which the greatest pressure in walking is exercised becomes excoriated or covered with painful corns, and sometimes severely inflamed.

Treatment.—The general treatment applicable to ankylosis (p. 58) may be resorted to with equal advantage in slight cases, in which the stiffness of ankle does not amount to apparent immobility. But if, from the duration of the affection, the intensity of contraction, or the failure of less active means, the case be judged irremediable without section of the more prominently contracted muscles, you may perform this operation; and it is fortunate that the treatment is liable to be attended with fewer inconveniences and interruptions than the similar affection of the knee-

joint. Should contraction in the extended position of the foot exist, subcutaneous section of the tendo-Achillis will, in most cases, sufficiently relax the articulation to permit its restoration; if the foot be rigidly fixed in the position of talipes equino-valgus (elevation of the heel with eversion), the peronei may require division; if in that of T. equino-varus (elevation of the heel with inversion), the posterior tibial tendon* and plantar fascia should be included in the operation. In slighter modifications of each of these varieties, you should be satisfied with severing the tendo-Achillis, and trust to mechanical extension for the elongation of the remaining contracted muscles and fasciæ.

[The subjects of figs. 19, 20, 21, were treated from ten to fifteen years ago by section of tendo-Achillis only. The author has frequently heard from the patients and from medical friends that the restoration has been complete and permanent, no tendency to recontraction and deformity having been manifested.

Division of tendo-Achillis is perhaps the simplest and least painful of surgical operations, effected in a few seconds, and absolutely without any effusion of blood. For many years past the author has been accustomed to place the patient in the prone position; and whilst an assistant endeavours to bend the ankle, introduces a small straight tenotome through the integuments from behind forwards at the side of the tendon. As soon as the point of the instrument is judged to have reached the anterior surface of the tendon, it is passed in front of it; the cutting edge is then directed to the tendon, severing the tense cord by one or two movements of the blade against it, and without wounding the integuments, except by the puncture of entry. The assistant should carefully relax the pressure he may be exercising upon the foot in proportion as he feels the part is cut through.

* The author has omitted the assertion that the flexor longus pollicis may require division.

Division of peroneus longus and brevis is similarly effected by placing the patient prone, or somewhat on one side, an assistant holding the foot inwardly, so as to maintain extra tension upon the parts to be severed.

In the few cases of stiff-ankle (partial ankylosis) requiring section of posterior tibial, the tendon of this muscle is usually so prominent to the eye and touch above and behind the internal malleolus (see *p*, *t*, fig. 20), that it is an easy matter to sever it by inserting the point of a narrow straight scalpel at the posterior edge of the tendon, directing it forwards between the tendon and tibia, so as to divide it without risk of injury to the posterior tibial artery or internal saphena vein.

It is unnecessary to give particular directions for division of plantar fascia, those given respecting operations on other tendons being amply sufficient. However, its division is not commonly required in partial ankle-ankylosis. After any of these operations, when any mobility of the joint exists, the limb should be placed upon a splint. But in the majority of the cases of ankle-ankylosis requiring operation, the part is so stiff that no splint is requisite. Gentle extension may be commenced after the lapse of two or three days.]

I shall describe the apparatus applicable to these cases in a future lecture on some other deformities of the ankle. (See Club-foot.)

LECTURE VI.

Contracted toes from rheumatism and improper shoes — Deformities of the shoulder, elbow, wrist, and finger-joints — Treatment — Deformities from causes indirectly affecting the articulations— Contractures— Distortion from simple repose of a member; from superficial or deep abscess; from laceration, sloughing, gun-shot wounds among the fleshy parts; from burns, cicatrices, ulcers, and cutaneous disease; from hypertrophy and induration of fascia.

Rheumatic inflammation of the entire foot is occasionally succeeded by considerable rigidity of the phalangeo-metatarsal articulations, with thickening of the tissues surrounding them, and much deformity—partial ankylosis. The metatarsal articulation of the great toe is more apt to suffer than the remainder, and more particularly from gouty inflammation. Occasionally the affection of these minor articulations co-exists with contracted ankle-joint, or it may be accompanied with considerable contraction of the muscular and fibrous tissues of the sole, in which case the retraction of the flexor tendons causes rigid flexion of the whole of the phalanges, except the first phalanx of each toe, which remains extended, in consequence, I believe, of the resistance opposed to the flexion of the whole of the phalanges by the extensor tendons. On examination you will find the flexor and extensor tendons equally contracted; but

Fig. 22.

*Contracted toes from rheumatism, relieved by section of flexor tendons.**

* The patient was a military officer, who in consequence of the pain and lameness experienced during locomotion had been invalided. He was restored to perfect activity.

as the contraction of the extensors is consecutive, the relief of the contraction of the flexors will, unless the case be of long standing, enable the toes to resume their proper position.

Considerable inconvenience in walking is experienced from this contraction of the toes; less, indeed, from the simple alteration of their position, than from the pain produced by the weight of the body being continually thrown in an improper manner on the metatarso-phalangeal articulations. In the natural relation of these parts the inferior round extremity of each metatarsal bone is received into the concave articular surface of the corresponding phalanx, and the metatarsal bone and phalanx each obtains its share of the weight imposed on the anterior extremity of the foot in locomotion; but when the first phalanx is extended in the manner above described, the inferior part of the articulation, and the round head of the metatarsal bone, are more exposed to pressure, and the ligaments are incessantly stretched and inflamed, causing continued suffering in walking.

Friction and manipulation should be employed in the *treatment* of these cases when they are slight; but as articulations affected with rheumatism usually remain tender for a considerable time after cessation of the inflammatory process, the patient will scarcely desire or permit any attempt to remove the resulting deformity until considerable inconvenience has been experienced. These cases commonly exist during several years before relief is sought, so that you will rarely be enabled to effect their restoration without section of the flexor, and sometimes of the extensor tendon. When the complication of contraction in the sole exists, division of the plantar fascia may be essential. After the operation, and cicatrisation of the punctures, each toe should be secured by adhesive plaster, or by bandage, to appropriate splints, by which its perfect straightening may be accomplished.

A contracted and deformed state of the metatarsal joint of the great toe, and of the articulation of the first phalanx with the second phalanx of the second toe, produced by wearing improper shoes, is very common, and requires to be treated on principles similar to those which are applicable to contraction from rheumatism.

Figs. 23 and 24.

Partial ankylosis of second toe and metatarsal joint of great toe contrasted with well-formed foot.

[In cases of deformity of metatarsal joint of great toe, as represented *b*, fig. 23, much pain is experienced on locomotion from a state of constant chronic inflammation of the articulation, the principal seat of the suffering being the internal surface of the joint. It would appear that the internal lateral ligament of the joint especially suffers, in consequence of the tension maintained upon it through the habitual thrusting outwardly of the extremity of the toe. In time the extensor tendon of great toe, the altered direction of which is seen in relief, fig. 23, tends to increase the deformity. Removal of the pain experienced at *b* is obtained by lightly bandaging a thin splint of wood or whalebone along the inner margin of the foot and great toe, avoiding pressure against *b* by suitable padding.

By means of this splint the great toe is gradually

brought into a line with the inner margin of the foot, the lateral ligaments are no longer stretched, and unless an improper shoe be again worn, the parts soon recover a healthy state. Remedies calculated to relieve chronic inflammation of the joint may occasionally be required. Some severe cases of this deformity depend upon the simultaneous operation of another cause—relaxation of the tarsal arch, as in flat-foot. The natural direction of the toes is slightly outwards (fig. 24); consequently, when an undue strain is exercised upon the muscles of the toes, through the sinking of the arch, an excessive eversion of phalanges results. The sinking of the arch affects principally or exclusively the internal part of the sole, and consequently the great toe mainly suffers.* Other forms of contracted toe of similar nature occur; but as their treatment will be intelligible from what has been here stated, it is unnecessary to dwell upon the subject.]

I have so little to say concerning contractions and distortions of the upper extremity from injury and disease of the articulations, that I shall be able speedily to dismiss the subject. A stiff immovable shoulder, from rheumatic inflammation of the capsular tissues and articular surfaces, affords a not uncommon example of incomplete ankylosis. The obstacles to the recovery of the articulation thus affected are, first, the tender state of the articulation remaining after cessation of the acute stage of the rheumatic inflammation, probably from persistence of chronic inflammation; secondly, alteration of the quality of the synovial secretion, with thickening of the capsular structures, and perhaps occasionally membranous adhesions, the whole of the symptoms being aggravated by the long-continued cessation of the use of the part, and consecutive muscular contraction. The symmetry of the part is destroyed, principally from wasting of the deltoid. You may sometimes be enabled

* Vide paper on pathology of this deformity, read at London Medical Society, Nov. 9, 1850, by Mr. Coulson.

successfully to treat such instances of imminent complete ankylosis, even where other articulations may have been previously affected with true ankylosis,—first, by the administration of iodide of potassium or quinine, and sometimes by colchicum and alkaline remedies, according to the condition of the stomach and kidneys, and of the general health; secondly, by counter-irritation, frictions, manipulations, and passive movements of the joint.

Another deformity, the consideration of which properly belongs to this place, is the *long-unreduced dislocation of the shoulder*, occurring from accident. These cases, formerly considered irremediable, illustrate the advantages resulting from division of tendons, as a preliminary to mechanical efforts to reduce the displaced bone. Dieffenbach has related two instances, the one in which reduction, after two years' luxation, was readily accomplished, with perfect recovery of the function of the joint, through section of the tendons of the pectoralis major, latissimus dorsi, and teres major and minor muscles. In the other, luxation having existed "many years," the same tendons, as well as the articular capsule, were divided, with only indifferent success.

[Many cases are scattered amongst the periodicals of the last few years illustrative of the utility of tenotomy in reduction of fractures and dislocations.*]

Stiff elbow-joint occurs more commonly than any similar affection in other parts of the upper extremity. In addition to ankylosis from traumatic causes, the mobility of the elbow is often annihilated by rheumatism, by abscesses consequent on fevers, and, even more frequently, by strumous disease of the articular extremities. When it results from traumatic or rheumatic inflammation, the immobility may be considerable, depending, nevertheless, on thickening of the ligaments and tissues exterior to the joint, and

* Tamplin, *London Medical Gazette*, July 1850. Campbell de Morgan, *Dublin Medical Press*, Dec. 1849.

slight, if any, adhesions within. Consequently, entire mobility may be regained by a judicious use of the means hitherto enumerated.

[In the elbow, owing to its complicated structure, perhaps more than in any other articulation, it is important not to neglect the use of manipulations and occasional instrumental bending of the part during the employment of extension (p. 27). A case of incomplete ankylosis of elbow in the flexed position, which, after straightening, could not again be bent, fell under the observation of Mr. Lonsdale. Malgaigne, in his recent classical work on fractures, states that immobility of a joint in the extended position only is followed by ankylosis, through the muscles *upon all sides of the member* powerfully pressing the articular surfaces against each other, and thus exciting a morbid action in them, favourable to complete ankylosis.]

Caries of one or more of the articular extremities often succeeds struma. The mobility may then be free within a given range, probably to the extent of a third or a half of the natural movement; but a sudden check to further flexion or extension, according to the direction of the resistance, will be experienced on examination. The performance of perfect extension is more often interfered with than flexion. In these cases restoration can only be effected by persevering gradual application of mechanical power and the auxiliary remedies. Various instruments, the majority consisting of different applications of the common male and female screw [or ratchet-screw], have been recommended for this purpose. In slight cases, a common straight splint, bound with moderate tightness, will suffice. Tenotomy may be advantageously resorted to in cases that have long existed. The parts which you may have to divide are the tendon of the biceps, and sometimes the mass of muscular fibres arising from the external condyle of the humerus.

[These are cases in which anæsthetics for the purpose

of aiding an accurate diagnosis are available. See p. 43. Too sanguine a prognosis should be avoided.]

The *articulation of the wrist* is peculiarly liable to become contracted from accident or disease. Often the amount of induration beneath the integuments and fascia of the part is so considerable as to occasion doubts of the existence of complete osseous adhesion of the bones. Occasionally, when voluntary movements by the muscles of the joints are entirely suspended, passive movements of the part, as of other articulations which are similarly affected, are accompanied with a distinct crepitating sensation, perceptible to the ear and touch. A roughness of the articulating surfaces, depending either on diminution or cessation of the secretion of the synovial membrane, on ulceration, or attrition of cartilages and probably most frequently, in gouty cases, on the crystallisation of the urates of soda, or ammonia and phosphate of lime (tophaceous matter), secreted within and around the articulation. The articulations of the fingers are equally liable to ankylosis from the causes here mentioned, and the deformity produced in them by gout is very considerable. Occasionally the cretaceous matter is so abundant that the superincumbent skin yields to the pressure exercised from within outwardly, and is slowly removed by absorption, rarely with suppuration. By these means the tophaceous matter, constituting "chalk-stones," is thrown out.

Fig. 25.

Deformity of hand after rheumatism, from Cruveilhier. A common deformity, often combined with much eversion of fingers.

[In many cases of incomplete ankylosis after rheumatism, the articulations of the phalanges have undergone so great a change, in consequence of erosion of articular surfaces, as to render restoration impossible. In others the contraction and deformity have resulted from extra-

articular disease, rheumatic affection of ligaments, muscles, and tendons; perhaps, sometimes, of the muscles and their tendons only.*

The study of fig. 25 throws light on the manner in which contraction of muscular structures produces deformity. In the majority of deformities—as, for example, in those produced by spasm and paralysis—volition is so greatly impaired, that one set of muscles obtains a decided preponderance, and the part is contracted in the direction of flexion or extension only, as the case may be.

In this particular rheumatic contraction, however, we find that both sets of muscles, flexors and extensors, volition balancing them, are shortened; the result of which is, that the total length of the member (the hand) is diminished, one row of phalanges (the first) being flexed, the next (the second) being extended, and the terminal row again flexed. Compare with this figure the hand represented page 109, in which the whole of the phalanges are flexed.]

As regards the *treatment* of stiff wrist, I may observe to you, that if the deformity have arisen from accident, or phlegmonous inflammation, or if the cause have been struma, the case being complicated by the cicatrices of fistulæ in different situations among the carpal bones, and complete immobility exist, it may be considered incurable. But in cases of incipient ankylosis from "rheumatic gout," all appearance of inflammation having subsided, you may be enabled to restore the functions of the part.† Frictions, manipulations, baths, the internal administration of iodide

* A deformity induced by disease of muscles and tendons only should come under the head of *Contracture*, rather than under that of incomplete ankylosis, illustrating the common observation in natural history, that objects in nature are not capable of that absolute separation into classes which scieuce, for convenience, demands.

† Extended observation shews that this apparently incipient ankylosis is more often a state of contracture, no alteration of the articulation itself existing. The author has restored numerous hands and fingers contracted by rheumatism simply by manipulations.

of potassium, and attention to the functions of the liver and kidneys, constitute the remedies you should employ.

Ordinary *stiff wrist-joint*, occurring from common inflammation, whether preceded by accident or not, usually yields to the general remedies that are applicable to all cases of false ankylosis. Sometimes the flexor tendons remain tense and contracted, and insuperably oppose every attempt at mechanical extension. Tenotomy should in such cases be resorted to, and the resistance offered by the palmaris longus, the flexor carpi radialis, the tendons of the flexor sublimis, and even the flexor carpi ulnaris, may thus be removed. The section of as many of these tendons as may be necessary should not be effected by a common puncture; each should be divided at a different distance from the articulation, or on successive occasions, so as to obviate the chance of their becoming agglutinated in a common subcutaneous cicatrix, and consequent impairment of function. I shall more particularly allude to these operations when describing to you the deformities from paralysis and spasm.

The apparatus you may employ to effect straightening of the wrist may consist of a series of metallic splints, adapted to the size and form of the hand and arm, and bent at different degrees opposite the wrist. By commencing with the application of one that is bent to nearly the same extent as the affected joint, the pressure is readily borne. [Straight splints connected by an adjusting ratchet-screw may also be employed.] Similar deformity of the fingers, generally, yields to [manipulations and] mechanical means, unless the flexor tendons have sloughed, or become adherent to their sheaths, from the previous inflammation. Occasionally you may find section of the flexor tendon [in the palm] requisite. A finger is more unserviceable and deformed when fixed in a straight position; this is usually preceded by destruction of the flexor tendon: the extensor then draws the finger unnaturally

backward. Division of the extensor would be inoperative when the three phalanges are united into one bone. It is probable that a finger which is ankylosed in this manner may be transformed into a useful member by dividing one or more of the phalanges, and causing reunion to take place, in a curved position.*

I proceed to consider a very important class of deformities, namely, those which arise from *causes indirectly affecting the articulations*, to which I assign the term of

Contractures.

The class of deformities the description of which I have just concluded, is produced by causes which operate *directly* on the joints, viz. injuries and inflammation in its various forms. If you have well understood my remarks thereon, you will remember that the serious character of those deformities depends on organic changes in the articular structures. The study of contractures will be facilitated by considering that the important articular structures are not necessarily involved in any morbid process. The deformities which I shall include in the term *contracture* are probably more numerous than those which are comprehended under any other subdivision, and therefore I shall detain you with some remarks on contracture in general before describing the individual distortions of this nature. This is the more necessary, as I am aware of no adequate source of information on this subject to which I can refer you.

Contracture is the state of imperfect mobility, rigidity or immobility of an articulation, produced and maintained by causes which operate at a *distance* from the articulation. It is a *passive* state, the effect of contraction, and not the contraction itself, with which it is often confounded. The

* Dr. Gordon Beck, of New York, has since performed a similar operation. A knee-joint completely ankylosed at a right angle was restored to nearly a straight position by removal of wedge-shaped portions of femur and tibia.—*Medical Gazette*, May 1846.

term has been applied by French writers to the muscular retraction of the limbs of children, produced by "spinal irritation;" but it requires, in my opinion, a more extensive application. In the lectures on deformities from ankylosis, I have shewn you that in those affections the passive organs of motion are the parts primarily diseased; whereas in contracture the articulation becomes only secondarily involved, the parts primarily implicated being the active organs of motion, the muscles and tendons, or the skin and aponeuroses. In both affections the abnormal condition of one set of structures ultimately involves the other, deformity from disease of joint (ankylosis) being combined with muscular contraction, and this condition of muscles, when primary, inducing ultimately rigidity and shortening of ligaments, but never true ankylosis.*

Fig. 26.

[This figure should have appeared at page 76, in lieu of fig. 12. It exhibits incomplete knee-ankylosis from strumous disease, with much sub-luxation, and numerous indented cicatrices resulting from suppuration, restored to straight and serviceable position by section of ham-strings. Fig. 12 should have appeared on this page, as it represents a knee-*contracture* from phlegmonous erysipelas, in which the articulation was only *indirectly* affected.]

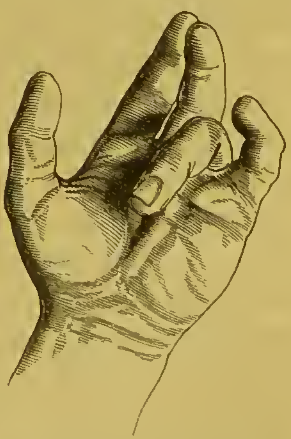
Contracture may, therefore, be produced by various causes which disturb the equilibrium of antagonist muscles; namely, simple rest of the part [habitual use of in certain occupations, retention in one position], as in the distorted limbs of superstitious devotees in India, extensive erysipelatous inflammation, abscess beneath the superficial fascia or burrowing among the deeply-seated muscles, loss of substance in the muscles and tendons from

* Malgaigne, in opposition to Cloquet and Tessier, adopts the opinion advocated by the author, that repose or immobility of a joint is not alone capable of producing ankylosis, but that inflammation, or one of its results, is necessary for the purpose; and quotes a case related by Cruveilhier, in which, after 60 years' immobility of the jaw, no ankylosis existed. (*Treatise on Ankylosis*, by the Author, 1843.)

sloughing, gangrene, laceration by machinery, gunshot wounds, and burns, the cicatrix of which contracts the adjacent articulation. The long continuance of a sore state of the cutaneous surface, which favours repose of the limb, or its voluntary retention in a particular position, as from inveterate psoriasis, or eczema, or from an obstinate ulcer, may induce contracture of the neighbouring joint.

An interesting case of contracture from a superficial ulcer of many years' duration, was recently shewn to me by my colleague at the London Hospital, Mr. Curling. Contractures from a sore state of the cutaneous surface result, in my opinion, from the voluntary retention of a limb in a position calculated to relieve the soreness. It is at the same time not improbable that in some instances an incident and reflex action of the cutaneous nerves (*viâ* the spinal cord) on the motor filaments of the subjacent muscles may be a cause of their contraction; at all events, the fact of the occurrence of morbid muscular contraction from irritation of the cutaneous surface may, as Stromeyer remarks, lead with more confidence to the therapeutic employment of vesicatories and rubefacient applications, as a means of restoring tone to debilitated muscles.

Fig. 27.



Contracted finger from disease of palmar fascia.

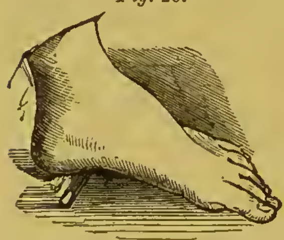
Hypertrophy and induration of fascia, whether obviously preceded by inflammation or not, are often accompanied by shortening in its fibres and contracture of the nearest articulation, as in contracted fingers and toes, from disease of the palmar and plantar fasciæ. But the most frequent causes of contracture are spastic contraction and paralysis of muscles, both of them being causes which destroy the equilibrium [maintained by the will] of opposing sets of muscles.

LECTURE VII.

Spasmodic contractures — Distortions from functional or organic disease of brain and spinal cord — Spastic contraction of a single muscle, of a set of associated muscles, of analogous muscles in upper and lower extremities — Effects of spastic contracture — Disturbance of symmetry of frame—[Origin of rigidity of limbs in new-born infants—Asphyxia neonatorum] — Paralytic contractures — Points of resemblance with spastic contractures — Apparent anomalies — Talipes calcaneo-valgus.

THE simplest case of contracture from spastic contraction is that of the slightest form of talipes equinus,* or T. equino-varus, *gradually* induced by derangement of the mucous membrane of the alimentary canal, whether it arise from the irritation of worms and improper food, or consist of chronic inflammation. The series of morbid phenomena is produced by means of the chain of filaments on which the reflex functions of the nervous system depend. Contraction of the sterno-mastoid muscle, producing wry-neck, may have a similar origin. [Frequently a spastic contraction of a muscle and consequent deformity of the member are gradually produced by imperfect nutrition and impairment of the general tone of the individual. The deterioration of health is principally evinced by derangement of the nervous system, of which the spastic contracture is the outward manifestation. Such cases are analogous to chorea as respects predisposing and proximate causes, especially in the earlier stages of that disease, when, as sometimes happens, the functions of a single muscle, or the muscles of a single articulation, may be impaired. The

Fig. 28.



Talipes equinus slight.

* Talipes equinus—elevation of heel, T. equino-varus = elevation of heel with inversion of toes, as in fig. 21.

spastic contraction of muscle, which produces contracture, differs, however, by its permanency, from the involuntary but transient muscular contraction of chorea.]

Other cases occur in which the deformity takes place

Fig. 29.

Wry-neck from spastic contraction of sterno-mastoid muscle.

more rapidly, depending upon *sudden* derangement of an internal organ, involving a peripheral part of the nervous system (as in a respiratory or chylopoietic organ), or on some functional or organic disease of its central parts—the brain, cord, or investing membranes—the spastic affection being sudden, and the *contracture* of the articulation complete.

The effects of the derangement of the brain or cord may be limited to the functions of a single muscle, as the gastrocnemius in talipes equinus, or the sterno-mastoideus in the simplest case of wry-neck; or a larger number of nervous filaments and more numerous muscles may be fected, as in talipes varus (figs. 30, 46), in which the adductors of the foot are attacked conjointly with the gastrocnemii; or, as in severe wry-neck, in which the scaleni, trapezius, and probably other muscles, are implicated.

The injury may be confined to certain nerves distributed to one lower extremity, or the same parts of both limbs

Fig. 30.

Spastic non-congenital Talipes varus. That placed uppermost is a front view: the one on the left is a posterior view; and that on the right, the foot seen from behind. The letter *a*, in each drawing, indicates the tendon of the anterior tibial muscle; *b*, in the drawing on the right, shews the situation of the external malleolus; *c*, in the uppermost drawing, a process corresponding with the anterior extremity of the os calcis; *d*, in each, the heel raised from the ground; *e*, the posterior extremity of the fifth metatarsal bone; *f*, the tendo-Achillis, passing in a curved direction to the posterior tuberosity of the os calcis, apparently deviating inwardly,* but actually having its insertion nearer to the external malleolus than in a sound limb; *g*, in the left drawing, the outline of the tendon of the posterior tibial muscle.

* The heel and tendo-Achillis are generally described as being twisted inwardly in Talipes varus; it will nevertheless be found, that although the tendo-Achillis passes in a curve towards its insertion, the convexity of the curve being directed to the fibula, its course, and the posterior extremity of the heel, are actually nearer to the external malleolus than in the natural relation of these parts. The curve formed by the tendon is probably caused by the rotation of the foot on its antero-posterior axis; the approximation of the posterior extremity of the heel to the external malleolus results from the navicular bone being drawn by the anterior tibial muscle towards the internal malleolus, and the consequent adduction of the foot. The adduction being

may be deranged. A corresponding arm and leg may become contracted, in which case it will be found that the muscles of the upper extremity analogous in situation and use to those in the leg will be seized. Thus, if the gastrocnemii be spasmodically contracted, the flexor muscles of the wrist will be the parts involved in the upper extremity; if the gastrocnemii and adductors of the foot be affected, the flexors and pronators of the wrist will be conjointly disturbed. When both lower extremities suffer, both arms not unfrequently participate in the disturbance.

Fig. 31.

Contracture of hand from spastic shortening of flexors and pronators. Biceps cubiti also contracted.

On simultaneous seizure of the four extremities, a greater tendency to spontaneous restoration, or a greater susceptibility to the operation of remedies, is evinced on one side of the frame than on the other, usually on the right side; so that the patient, when presented to your notice for relief of the resulting deformity, has partially or completely recovered the use of one arm or leg.

Analogous muscles in the upper and lower extremities, and those most frequently associated in their physiological actions, are liable simultaneously to participate in spasmodic affections, and to become simultaneously contracted, inducing particular contractures. This is so invariable as to amount to a pathological law. In the natural actions of

effected by a horizontal rotation of the astragalus, the posterior extremity of the tarsus, formed by the os calcis, is thrown outwardly, in proportion as the front part of the tarsus and foot are drawn inwardly.

the upper extremity the flexor muscles are more commonly associated with the pronators (of which, in the leg, the adductors are analogues), the extensors of the arm with the supinators (in the leg the abductors); and when the upper extremity is affected with spastic contraction, the flexors will be observed to suffer conjointly with the pronators (in the leg the flexors* with the adductors), the extensors of the arm concurrently with the supinators (in the leg the extensors with abductors).

Fig. 32.

Contracture of knee and foot from spastic shortening of flexors (ham-string muscles, muscles of the calf, flexors of the toes) and adductors (anterior and posterior tibial muscles).

This law applies not simply to the *abnormal* actions of the muscles of a single limb; for when the upper and lower extremities are simultaneously affected in the same individual with spastic contraction, an exact correspondence occurs, the flexors and adductors of the leg suffer together with the flexors and pronators of the arm, and never (?) conjointly with the extesnors and supinators. When the extensors and supinators

* The lecturer here explained that he agrees with Rudolphi, Walther, Palletta, and other physiologists, in applying the term *flexors* to the gastroencmii and other posterior muscles of the leg. He stated that they are called *extensors* of the ankle-joint by some anatomists and surgeons, because they straighten the foot by elevating the heel; but from the facts narrated in this lecture, it is apparent that they correspond pathologically with the flexors of the fore-arm and fingers. As regards anatomical position they are unquestionably flexors. As an additional proof that they should be regarded as flexors, he remarked the circumstance, that in the quadrumana the hind-feet are, by means of these muscles, used for grasping as readily as the fore-feet.

of the arm are affected, the extensors and abductors of the lower extremity participate in the disorder. The flexors and adductors are more obnoxious to spasm than the extensors and abductors.*

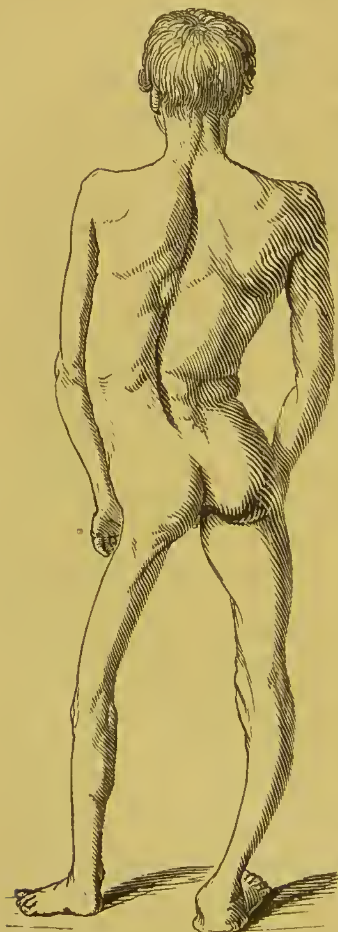
A more considerable derangement of the functions of the spinal cord may occasion tonic contraction of a larger number of muscles; the flexors of one or both knees (fig. 32) may be affected, or the biceps flexor cubiti (fig. 31), inducing contracture of the knees or elbows, contracture of the foot always accompanying the contracture of the corresponding knee. When the spasmodic affection is *gradual*, you will find that the muscles most distant from the nervous centres are first affected; whence it may be inferred that a smaller degree of disturbance in the central organ, whether originating there or excited by disease in peripheral parts of the system (reflex), may suffice to produce spastic contraction of the muscles of one articulation, as the ankle or wrist; and that on increase of derangement in the central organ, the muscles of other joints, as the knee and elbow, the hip and shoulder, become successively involved, the progression being from the articulations most distant to those nearest the trunk. Contraction of the flexor tendons of one or more fingers is sometimes the first symptom of spastic contracture in the arm; and contraction of the flexor longus pollicis pedis, and of the smaller muscles of the sole, often precedes spastic rigidity of gastrocnemii, and other muscles of the leg, in this form of non-congenital talipes. You will remark the coincidence in this respect between the progress of spasm and paralysis, when gradual.

A *sudden* attack of spasmodic contraction may, in proportion to its severity, attack the hand or foot, the knee and elbow, the hip or shoulder, singly or all together. In the thigh the adductor and flexor muscles, and in the shoulder the latissimus dorsi, the teres major and minor,

* The author has here omitted an hypothesis to explain the reason of the association of certain muscles.

and the pectoralis major, are concurrently affected with the pronators, adductors, and flexors of the wrist and foot. The muscles of the head and trunk, of the eye, the organs of speech and deglutition, are sometimes involved in the disturbance, inducing squinting, stammering, or mis-enunciation, risus sardonicus, blepharo-spasmus, [spasmodic dysphagia], wry-neck or opisthotonos, from tonic contraction of the posterior muscles of the head and those of the cervical and dorsal portions of the spinal column. I have witnessed seizure of platysma myoides and the muscles inserted into the ramus of the jaw, and consequent deformity of the face from depression of the affected side of the maxilla. [In such a case the ramus of the inferior maxilla may appear rudimentary, and much approximated to os hyoides.]

Fig. 33.



*Want of symmetry of left half of frame from cerebro-spinal disease.**

The muscles affected with spastic contraction may be in part or wholly removed from the influence of volition; their development is proportionally interrupted, and a cessation of growth, or even atrophy, results. Occasionally hypertrophy precedes the

* The apparent spinal deformity is produced by shortening of left leg, and disappears on interposing a book of suitable thickness between the foot and the ground. The outward curvature of right leg is caused by a spontaneous yielding to accommodate itself to the opposite shortened member. The deformity of the right ankle is caused by the oblique direction in which the weight of the body is thrown upon it in consequence of the curved leg.

atrophy, as already mentioned. Other structures, as the bones, suffer in proportion, and the nutrition of the entire organ is imperfect. If both sides of the body be interested, the size of the affected parts will commonly be found smaller than those of healthy individuals; and if one side of the body only be affected, the normal development of the one side compared with the atrophy of the other occasions a remarkable want of symmetry. This is often perceptible in the whole of one side of the frame; one half of the head, neck, chest, abdomen, pelvis, and extremities, even when contracture exists in the limbs only, being smaller than the opposite. It is incomparably greater than that occasional want of symmetry observed by anatomists and sculptors, which is not incompatible with integrity of function.

The contractures of which I have hitherto spoken are referrible to spastic contraction of one or more associated sets of muscles, which is the common form of the disease; but you may meet with rare cases, in which the whole of the muscles of the extremities, flexors and extensors, adductors and abductors, &c., appear conjointly spastically affected, the entire muscular system being permanently affected with tetanic stiffness, flexion preponderating in the extremities, probably through the powers of the flexors and adductors exceeding that of their antagonists. Sometimes flexion predominates in the trunk; at other times extension, in which case the anatomist is reminded of the fixed retracted state of the head observed in hemicephaloid fœtuses.

Fig. 34.

General spastic contraction of the lower extremities.

In some cases the physician is strongly reminded of chorea, by the jerking irregular manner in which the individual endeavours to use the limbs.

[Every form of contracture arising from spasm, which

I have described, may present itself either as a congenital affection, or as the result of disease during infancy. It is often difficult, and sometimes impossible, to discriminate whether the case be congenital or acquired. A common accompaniment of [congenital or acquired] contracture in a large proportion of the voluntary muscular system, as of two or more extremities, and particularly when at the same time the muscles of the face and throat are involved, is an impairment of the intellectual powers. This may be slight, and evinced simply by excessive unsteadiness in application to intellectual pursuits, great irritability of temper; or more severe, causing ungovernable temper, uncontrollable tendency to destroy objects, cunning, hebetude, and weakness of every intellectual faculty, even complete idiotcy. In some instances, however, the weakness of intellect has appeared to result less from permanent injury to the brain than from the want of sufficient training and education after its recovery from the severe physical shock it had received. Epilepsy is an occasional complication.

In many instances the spasmodic affection is produced at the moment of birth, or within a few hours or days of that event. In the majority of the cases of universal contracture of the upper and lower extremities which have fallen under my observation, the subjects were born at the seventh month, or prior to the end of the eighth month of utero-gestation. In two cases the birth occurred at the full period of gestation, but owing to the difficulty and slowness of parturition the individuals were born in a state of asphyxia (asphyxia neonatorum), resuscitation having been obtained at the expiration of two and four hours, through the persevering efforts of the accoucheurs. The fact of the greater liability to universal spasmodic contraction of infants prematurely born is susceptible of two explanations. I have ascertained that the premature labours in question were rarely induced by mechanical injury or sudden application of other causes, such as excessive exertion or a vio-

lent emotion, but were consequent on derangement of the health of the parent of some duration. One explanation, therefore, suggests itself, that the deteriorated health of the parent had directly impaired the nutrition of the fœtus, and both directly and indirectly the healthy development of the nervous system of the fœtus, creating a susceptibility to disease.*

* Succinct report of a moderately severe non-congenital case of spastic rigidity, for which the author is indebted to Mr. Hollis of Brighton.

April 1844. A healthy, spare, wiry, fair boy, æt. four years, unable to walk unassisted; toes inverted, heels elevated during locomotion; spastic contraction of gastrocnemii, flexors of knees, adductors of thighs; knees separable eight inches only; volition still imperfect in hands, pronations and flexion preponderating; apt to drop things; trembles; when pleased, extends his limbs like an infant during excitement; when placed upon a chair without arms, or sofa, is in constant fear of falling; some difficulty of speech; much strabismus formerly, slight only at present. The whole attributed to "heavy fit of illness when cutting first tooth."—April 24th. The Achilles tendons were divided: immediately after operation great re-action of anterior muscles of ankle observed; splints on front of legs and feet applied to prevent bending: difficulty in keeping toes down experienced.—May 10th. Continued apprehension of imperfect union.—June 13th. Both tendons re-united; intermediate substance in right rather long; during the last three weeks has worn double upright irons; the knees maintained in extension during night and day; the limbs on removal of irons freely flexible and extensible; walks slowly when supported as well without as with irons; knees do not bend under him; knees have been separated by manipulations twelve inches; tendency to Valgus noticed. —July 15th. To substitute for the long irons short upright ones to tibia, as in treatment of Valgus.—February 16th, 1845. Has run alone three months, but is unable to walk slowly; he can stand *quite upright* unsupported.

The following is a still less severe case, attributed to an accident and subsequent illness at age of eighteen months, though probably dependent on partial asphyxia at birth.

April 1844. A stout girl, æt. eleven, dark eyes, fair skin, red hair, affected with spastic contraction of both gastrocnemii, especially of left; slight contraction of adductors of thighs and flexors of knees; volition in hands and arms imperfect; speech affected; irritable nervous system; appearance of general irregular muscular action, reminding of tendency to chorea; reported to have appeared quite well in health until the age of eighteen months, but was unable to walk alone. At that period she fell from off a chair; had "heaviness" for three days. Three weeks later she had stiff-neck, succeeded by "stiffness of limbs," supposed to be rheumatic. At four years old ran alone, always on her toes. In reference to the child's early history, it appeared that it was the mother's first pregnancy; labour natural. Two months before confinement the mother experienced a "fright," after which she never felt the movements in utero. The infant cried much for a few hours after birth, succeeded by convulsions and stupor of four or five days' duration; was unable to take the breast until five days old. Operation postponed until after trial of mechanical and physiological means.—April 1848. The left tendo Achillis was divided with complete relief of contraction. The same tendency to over-action of anterior muscles afterwards observed as in preceding case. Flexibility and increased volition were obtained in this leg and in other affected parts by diligent manipulations, regulated exercises, and attention to suitable clothing and general health.

The next is a severe case of spastic rigidity of limbs, with impaired in-

The second explanation that I may offer you, and one especially applicable to those cases of contracture concerning which doubt exists whether the spasmodic affection originated prior or subsequently to birth, is based upon the

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tellectual development, from Asphyxia neonatorum, with the particulars of which I was furnished by the parent, a surgeon in Oxfordshire.

"The male child of young and healthy parents, in consequence of protracted labour (it being the first child), was born asphyxiated, and continued so for above half an hour. The pressure, not instrumental, over the occiput, was to such an extent as to cause congestion and ultimately sloughing over the occipital protuberance. For several days the child was very feeble, and unable to cry aloud; during the first two days he had several convulsions, and did not appear likely to survive. However, after the bowels had been well cleared by an enema, he rallied, and was pretty well, although small in size. The only thing remarkable at this time was an awkwardness in taking the breast, so that during the first fortnight he was obliged to be fed from a bottle. At the age of two months he began to increase in size, and up to end of first year was remarkable for robustness. When nursing him, it was noticed that he did not retain his seat, but slipped off the hand or knee of the nurse. The period of deutition passed over without any disagreeable symptoms. His temper was always good. He appeared rather backward in the use of the legs, but this was attributed to his great weight.

"At two years of age the attention of the parents was drawn to his inability to walk or creep on the floor, as also to his backwardness in the use of the tongue and right hand. He was now put under the influence of electro-magnetism three times a week, of sufficient strength to be disagreeable to an adult; and during the summer was dipped in cold water every morning. He was once during this year subjected to a course of calomel for a period of three weeks, which induced jaundice, and made him much thinner. His bowels after this were continually costive, but he took very little medicine. He occasionally awoke in the night apparently frightened, and was a considerable time getting quiet again.

"Soon after his third birth-day he could say 'papa,' imitate the cow, and knew several letters of the alphabet; and in the early part of the year could raise himself on his knees to crawl, which was performed principally by the left leg. He could also distinguish several of the animals in a Noah's ark, and made an effort with left hand to set them up. The left angle of mouth was drawn down when making an effort to do any thing difficult, and a spasmodic twitching of the flexors of right leg was observed, which was increased when he attempted to use it. He sat chiefly on left nates.

"During the fourth year he was able, when the weight of the body was supported, to advance his legs regularly for progression. When on his knees he is apt to change position by throwing himself back, and sitting with the legs under him to play with his toys. During this year he was taken to Brighton, and bathed in the sea daily for six weeks. On his return his father perceived a great change for the better; there was greater animation, and the child was able to articulate the name of the bathing-woman. The mental powers began slowly to improve. About this time he was put under a course of steel medicine, which improved his health, and enabled him to use his legs more for support.

"At the commencement of his fifth year he was put under a course of sulphate of zinc, beginning with gr. j., and gradually increasing to gr. v. He had a boot with an iron attached outside to prevent a contraction of right foot, and a baby-jumper for exercise. He continued to improve up to his fifth birth-day, when he was able to walk slowly round the table, depending very much for support upon his hands, more particularly upon the left. He also pushes a chair before him, and can ride a rocking-horse without assistance. He uses his right hand better, can set up some of his toys, and also can feed himself with it. On taking up a ball, he can now, when he attempts to throw it, relax his hold of it. He begins to connect his words, and says many of them distinctly; he can

proposition, that an infant prematurely born is, although in a normal stage of development, inadequately prepared to contend against the operation of external agents. The respiratory and circulatory organs of an infant under these circumstances are ill-suited to the proper aëration of the blood, and its due transmission throughout the frame; the alimentary organs cannot yet be perfected for the elaboration of chyle, and the incomplete development of the nervous system must interfere with the assimilation of nutritive matter for the wants of the economy. It cannot occasion surprise that altered function, congestion, or disease of the most susceptible of the infant's organs, those of the nervous system, should occur. Hence the production in some cases of transient muscular contraction, convulsions, and death; and in others of permanent spastic contractions in various parts of the body, succeeded by the forms of contracture under consideration.

[Of twenty-four more recent cases of general spastic rigidity of limbs occurring amongst private patients, of which the author has preserved notes, there were:

Reputed to be congenital	7
Ditto non-congenital	5
Doubtful, or not observed until period of ordinary wlaking .	11
Reported to have been born at seventh month of gestation .	8
Ditto ditto at eighth month	4
Labour difficult, protracted, or having required instrumental aid in	7
Asphyxiated, or semi-asphyxiated, from half an hour to two days; convulsions usually accompanying or succeeding .	7
Attributed to difficult dentition	3

Numbers equally divided between the sexes.

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pronounce each letter of the alphabet, and knows the majority of them. He can also count up to 40, repeat the Lord's prayer, and a verse or two of hymns, with but little assistance. His health is at present good. He sleeps well, and eats heartily. His body is in good condition, and well formed; and there is no malformation about the spine or limbs. During the last twelve months he has been rapidly improving."

July 29th, 1851. The author's journal states he is now between five and six years of age, a favourable instance of this severe class of case. The right side is most affected. Although he walks in the manner of T. equinus, the feet can be flexed with the hand. The left hand appears little affected, in the

A large proportion occurred in the mothers' first pregnancy. Several of these children weighed at birth only about forty ounces. In several an hereditary tendency to disorder of nervous system could be traced; as, for example, a parent having suffered from epilepsy or hemiphlegia. The family tendency was sometimes shewn by brothers and sisters having analogous diseases. In half the cases the affection appeared equal upon both sides; in six the left side was more affected; and in the remaining six the right side suffered in a greater degree.

If the analogy between the spastic contraction which induces these contractures with the muscular contractions occurring in chorea, hysteria, epilepsy, and tetanus be remembered, the correctness of the rationale of the production of these contractures which I have given will, I believe, appear conclusive. Certainly chorea, hysteria, and even epilepsy, more frequently depend on exhausting influences maintained upon the nervous system, or on impaired assimilation of food, and consequent derangement of circulation and nutrition of the nervous centres (asthenic causes), particularly if the individual has derived any peculiar susceptibility of these organs from the parent, or otherwise acquired it, than on other causes which seem to act in a more sthenic manner. This opinion of the mode of production of congenital spastic contractures may be supported by the consideration of the frequency with which, during fœtal life, disturbance and disease of the brain and spinal cord is evinced by more serious phenomena than a contracted state of the limbs. It is known that a condition analogous, if not identical, with the serous effusion into the membranes of spinal cord, brain, and ventricles, which occurs during infantile life, is produced during embryonic

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right pronation preponderates over supination; the flexors are less troublesome than pronators. The father's report, Dec. 1852, is, "that he has mentally much improved; writes with right hand on a slate tolerably well; but being obliged to use so much force (to overcome the spasm), he does not do so well on paper."

development. The accumulation of fluid in the nascent cavities and envelopes of the brain and spinal cord (fœtal hydrocephalus, hydrorachitis) operates destructively by distension of the delicate textures of which these organs are composed, causing in some cases the abnormal condition denominated spina bifida, in others atrophy of a cerebral lobe, or of an entire hemisphere, or of a lobe of the cerebellum; and occasionally annihilation of the whole cranial vault and cerebral contents (hemicephalus, acephalus). In many instances these extensive *arrêts de développement*, as the abnormal states in question are not very appropriately called, co-exist with deformities of the limbs, as club-hand, club-foot, &c., and other *malformations*. In such cases the deformity of the limb has probably proceeded *pari passu* with the cerebral disorganisation.

There is no form of contracture more interesting than that of wry-neck (non-congenital), sometimes affecting the *sterno*-mastoideus only, as in fig. 29, at other times involv-

Fig. 35.

Non-congenital wry-neck from spastic contraction of sterno-cleido-mastoideus.

ing the clavicular portion of the muscle, as in fig. 35; in

which case the continued traction exercised by the muscle, besides producing obliquity of the head and distortion of the cervical portion of the spine, distorts the clavicle itself. Usually, when the deformity has long existed, the muscle is structurally shorter and atrophied, incapable of being elongated by the hand of the observer; sometimes, however, as when the morbid action of the muscle is truly spasmodic, convulsive, or intermittent, the nutrition, and consequently the size of the muscle, remains natural, or even hypertrophy, as in fig. 29, may ensue. In these convulsive cases the muscle may be stretched out by the observer, and the deformity be momentarily removed, the head relapsing on withdrawal of the replacing force. They are accompanied with distressing jerking movements of the head, often so severe as to require the support of the patient's hands—a state of things rendering retirement from society necessary. Paralytic wry-neck is rare,—see case, p. 122.]

Contracture from Paralysis

offers many analogies with that arising from spastic contraction of muscles; for notwithstanding the proximate cause may appear so opposite, it is often very similar, if not identical, in external form. One reason of this similarity is, that whilst the flexors, adductors, and pronators are more obnoxious to spasm, the extensors, abductors, and supinators are more liable to paralysis. For example, deformity from paralysis of the extensor and supinator muscles of the arm is the most common form of paralytic contracture in the upper extremity.

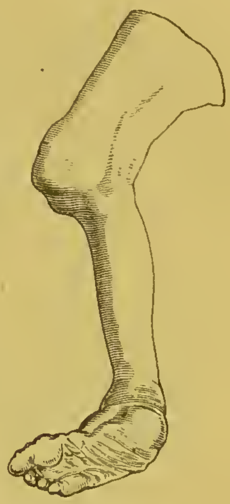
Fig. 36.

Paralytic contraction o hand. Shortening of the flexors and pronators.

And on the loss of power of the peronei and long extensor muscle of the toes (with which, as an exception to the ordinary law of association, paralysis of the anterior tibial

muscle is often associated), the muscles of the calf, posterior tibial muscle, and flexors of the toes, deprived of antagonists, gradually contract. Structural shortening, and atrophy of the fibres result, and by elevation of the heel and inversion of the toes, produce as perfectly formed talipes varus as that resulting from spastic contraction of these muscles. It is needless to multiply instances at present, as I shall hereafter consider the contractures of the individual articulations.

Fig. 37.



Paralytic Talipes varus, with similar form of knee-contracture.

A further analogy is offered by the circumstance that paralysis, like spasm, may induce contracture by affecting a single muscle or the associated muscles of one articulation; those of several articulations of an extremity, or of an arm and leg, or of both lower extremities. Paralytic deformity is rarely so extensive as that from spasm; thus paraplegia may have been the original affection, and contracture of every articulation of the lower extremities have resulted; but I have once only seen paralytic contractures in both the upper conjointly with *both* the lower extremities.* The entire system of voluntary muscles may have been originally paralytic, contracture having ensued in those parts only in which the paralysis has lingered.

I have witnessed paralytic deformity in both lower extremities conjointly with the left arm, restoration of the right arm having probably been facilitated by the habitual endeavour of the individual to use it, or from the primary paralytic lesion having been less severe. It occurs very frequently in one hand and arm, in which case the symmetry of the entire frame is disturbed, as from spastic

* This was written ten years ago, since which the author has seen other instances.

contracture. More complete atrophy is usually exhibited in paralytic than in spastic deformity, the vegetative functions of the paralysed parts, nutrition, and the generation of animal heat, being greatly impaired, probably in consequence of participation by the organic nerves in the mischief inflicted on the voluntary motor filaments.

Even in spastic deformity the temperature of the part is depressed; but this, as well as the diminished growth, appears to be less the result of any direct infringement of the functions of the organic nerves than of a want of the normal voluntary activity of the muscles, by which the active performance of the functions of nutrition is sustained. The impairment of the organic functions of the part is indirect.

An important difference between paralytic and spastic contracture is, that however complete and sudden the attack of paralysis, the resulting contracture is always gradual.

[Congenital *contracture* from paralysis very rarely occurs. I have witnessed only three undoubted cases of this nature. Paralysis succeeded by contracture has now and then appeared to arise before or at the moment of birth, in the same manner as spastic rigidity.* Paralytic strabismus and mis-enunciation sometimes co-exist.]

Some remarkable peculiarities in the history of para-

* The following is a case of paralytic relaxation of entire voluntary muscular system after asphyxia neonatorum, with small amount of contracture, for the early history of which the author is indebted to Dr. M'Intyre, Odiham, Hants.

"Mrs. **** was taken in labour of her second child at 2 o'clock A.M., Oct. 25, 1843; Mr. *** being in attendance. Breech case. The pains recurred regularly, gradually increasing in frequency and severity until a quarter past 7 A.M., when there being considerable difficulty in delivering the head, I was sent for. By the time I arrived I found it had been accomplished ten minutes, that the child was in a state of asphyxia, and that a slight gurgling was heard in its throat immediately after its expulsion. It was laid aside as dead. The limbs were flaccid, pale, and cold, as also the body; and the head, (from the traction, I supposed) was preternaturally movable. I proceeded to resuscitate it in the usual way by artificial inflation, warm bath, brandy externally, and frictions, certainly with very faint hopes of a favourable result. However, after about fifteen minutes, a slight fluttering could be felt in the cardiac region, and a continued use of the same means gradually improved its condition. This management was persisted in for an hour and a half, with occasional short intervals when the heart's action seemed pretty

lytic and spastic contractures occur, the study of which is of great interest. Thus you may sometimes meet with paralysis of peronei and anterior muscles of one leg attended with contracture similar in form to talipes varus, or T. equino-varus, the opposite leg of the same individual being affected with the contracture similar to talipes calcaneo-valgus from paralysis of gastrocnemii and anterior and posterior tibial muscles; the paralysis having affected the *abductors* and *extensors* (" flexors of the ankle" of some anatomists) in one limb, the *adductors* and *flexors* (" extensors of the ankle" of some anatomists) in the opposite member.

Fig. 38.

Paralytic Talipes equino-varus.

Before I proceed, it is necessary that I should briefly explain the form of contracture to which I have assigned

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strong, and resumed when it began to flag. At the end of two hours the breathing was tranquil, but weak. At 4 o'clock P.M. it cried a little, afterwards sipped a little sugared water, and in the evening cried most lustily.

" 30th. During the second and third days it had frequent convulsions, slight in character, affecting the whole body, accompanied with heat of head; and in the intervals was restless and fretful. Two leeches were applied to the head; cold affusion whilst in a warm bath, and a grain of calomel, followed by a drachm of castor oil were given, and acted freely. Cold applications were continued until the 30th (to-day), the heat of head, though diminished, being still above natural. Has had no convulsions since the 28th, and upon the whole is improved. Has not sucked. Bowels confined, for which this morning had an enema of ol. terebinth. half a drachm, mucilage three ounces, which acted freely.

" Nov. 10. No return of the convulsions; but an obstinate and protracted diarrhœa supervened, followed by great debility and emaciation, supposed to have arisen from the mother having taken much aperient medicine. It has now, however, much improved."

The author, in his journal, April 1847, thus describes it.

" Laxity of neck, head having inclined to right shoulder since birth; right sterno-mastoid muscle weaker than left; chin not so much rotated as entire head inclined to fall to the right shoulder; the whole of the limbs feel relaxed, without contracture or absolute paralysis; tendency to pronation of hands; can support herself against a wall; falls if her attention be abstracted; can utter a few words, and she looks intelligent; deglutition of fluids difficult.

" Nov. 1849. Considerable improvement, although some contracture of adductors of thighs has taken place; walks, the hands being held, and leaning with front of her body against attendant; can stand against sofa; the knees cross; intellect developing, when

the name *talipes calcaneo-valgus.* It is that species of claudication and deformity in which the individual walks principally on the calcaneum or heel, the toe being at the same time turned outwardly, as in valgus.

Fig. 39.

T. calcaneo-valgus, from paralysis of gastrocnemii and anterior and posterior tibial muscles. *a.* The internal malleolus; *b.* the projecting astragalus; *c.* the outer margin of foot raised from the ground.

You may sometimes observe this contracture of T. calcaneo - valgus in one foot from paralysis [of certain muscles, complete or partial], whilst T. varus may exist in the opposite limb from spastic contraction; or you may witness the spastic, non-congenital T. varus in the left foot, the right limb of the same individual being affected with complete paralysis of the whole of the muscles, without any contracture.

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requested can give either hand or foot; spells a few short words; knows persons and places; has feeble but correct use of hands.

"April 1852. Much contraction of adductors of thighs; chorea-like movements."

This case is further interesting by its suggesting the possible dependence of the asphyxia, convulsions, and paralytic debility upon mechanical injury to the neck at birth.

LECTURE VIII.

Contracture and causes—Nature of lesion in nervous centres in spastic and paralytic contracture—Mechanical injury to nerves—Concomitant disturbance of functions of sensorium—Spastic rigidity in newly-born infants—Morbid anatomy of contractures—Organic changes of articular surfaces do not necessarily follow prolonged repose of the member—Restoration of largest articulations after many years' contracture possible—Description of anatomical condition of knee contracted twenty-five years from paralysis—Absence of insuperable obstacles to cure—General treatment of contractures.

The observation of a large number of cases of contracture, in the production of which spasm and paralysis have been the efficient agents, more particularly the simultaneous occurrence in the same individual of both these diseased conditions, leads to the conclusion that the nature of the primary lesion in the central organ is the same in either case. The origin of one class of spasmodic contractures through a chain of incident and reflex phenomena, has been already described; the remaining spastic contractures, as well as the paralytic cases, whether congenital or not, arise from disease in the brain or medulla spinalis. Probably in the majority of instances the medulla spinalis is alone affected [?]. Contracture from spasm, or paralysis of a single muscle, of a set of associated muscles, or of the entire muscular system of an extremity, depends upon functional derangement or organic alteration in the central organ, limited to the roots of a proportional number of filaments of nerves distributed to the extremity. From the pathology of spasmodic diseases in general, it may be inferred that a higher degree of injury to the delicate fabric of the nervous tissue, or of the investing membranes, is required to produce paralysis of muscles than spasm. The

lesion is, in most cases, inflammation, chronic or acute, in either of its stages of congestion, effusion, or softening.

From the analogy offered by many spasmodic affections in their frequently transient nature, the smaller amount of atrophy accompanying spasmodic contractures, and the occasional occurrence of spasmodic contraction in an extremity as recovery ensues from complete paralysis, we may suppose that the slightest of the morbid changes in the condition of the capillaries of the nervous tissues or membranes—relaxation or congestion—may excite spastic action of muscles, and that the ulterior changes of effusion and softening induce sufficient compression and disorganisation of the nervous tissue to effect paralysis.* Morbid anatomy has not yet clearly revealed whether slight congestion of the spinal veins may not suffice to produce that degree of disturbance of the medulla from which contracture arises. It is demonstrated that an adequate congestion of this nature may produce paralysis.

In order to test the accuracy of this opinion, it can scarcely be objected that, if correct, paralysis, when gradual in its occurrence, should invariably be preceded by spasm; for, although relaxation of capillaries in a particular part of the central organ be adduced as the pro-

* In order to illustrate the dependence of spasm and paralysis upon different degrees of activity of the same proximate cause, or of the same morbid action (convertible terms), the author may relate an uncommon case which fell under his observation, in company with Mr. Tidy of Hackney, during all its stages. A robust male child, aged four years, was seized with severe rheumatism; in a day or two the symptoms reached an unusual intensity; the face presented so great anxiety as to suggest cardiac affection, which was disproved by physical examination of the chest. The child referred the greater part of his sufferings to the back; and it was noticed that the thumbs were drawn into the palms. Rheumatic spinal meningitis was diagnosed. Convulsions supervened; these, after several paroxysms, were succeeded by total paralysis of all the members. In a few days he began to rally, power was gradually restored to the limbs; but as the paralysis disappeared, contraction of flexors and adductors of lower extremities, and of the flexors and pronators of the arms, shewed itself.

bable cause of spasm, it does not follow that spasm should necessarily result from such relaxation, since it may be regarded as an occasional consequence only of that morbid change. Even the assertion that the morbid change in the nervous tissue which induces the perplexing phenomena of the spasmodic diseases in general depends on relaxation of the capillaries, is an assumption founded only on our ignorance of any other cause than inflammation* capable of producing the effects we witness, and on the opinion that relaxation is the physical change which takes place in the capillaries during that process.

Many pathologists suppose that the opinion of a simply dynamic change in the condition of the ultimate fasciculi of the nervous centres will suffice to explain the occurrence of involuntary muscular contraction,—such, for example, as chorea, hysterical contraction ; and it might be inferred that the same hypothesis will apply to the primary origin of the spastic contraction under consideration. It is probable that an altered dynamic, vital or electroid influence, is the first in the series of phenomena manifested in spastic contraction ; but in the present state of pathology this dynamic change can be presumed to produce its effects only by influencing the capillaries, as respects their action or tonicity, and their size.†

It cannot be doubted that when hysterical or other contractures have ceased to be transient, but have existed many weeks, months, or years, something more than a dynamic or functional change in the nervous centres has ensued. Relaxation, congestion, or other more considerable organic changes will have succeeded. You should, however, bear in mind, that after the lapse of time the

* By inflammation here is to be understood any of its numerous phenomena, stages, and phases. (See *Principles of Medicine*, by Dr. Billing.)

† This Lecture was delivered in 1843, before the discovery of the great share in pathological processes exercised by abnormal cell-nutrition was recognised. The author thinks it unnecessary to discuss what amount of influence in these disorders may also be exercised by morbid states of the blood.

lesion in the nervous centre may have entirely subsided, the deformity being solely maintained by structural shortening of the muscular structures.

Mechanical injury to a nerve in its course to an extremity may excite permanent contraction of the muscles to which its filaments are distributed, and a contracture may result. Delpech relates a case of talipes equinus caused by an injury of the ischiatic nerve from a gun-shot wound. I have recently had under my care a contracture from a similar cause in the person of one of the brave defenders of Kelat, in Affghanistan. [The gentleman in question received a sabre wound, which involved the biceps tendon, the head of the fibula, and the peroneal nerve. Paralysis of anterior and external muscles of the leg ensued, and the posterior muscles, deprived of antagonists, gradually produced rigid contracture of ankle, elevation of heel with inversion of foot (T. equino-varus).]

Compression of the spinal nerves as they emerge from the vertebral canal, resulting from deformity of the vertebral column, may induce spasmodic and paralytic contractures of the upper or lower extremities, according to the situation of the deformity. The spasm or paralysis may also result from pressure upon, or through production of organic changes in the medulla itself.

A common origin of these contractures is insensibility (coma) in infancy; either preceded by visible indisposition, as fever, diarrhœa, convulsions, or occurring suddenly (apoplexy), without premonitory symptoms. Sometimes the insensibility continues for many days, being succeeded by perfect paralysis of the entire voluntary muscular system. This usually subsides into hemiplegia, and subsequently wholly disappears, or contraction or paralysis of the muscles of an extremity or of several limbs remains.

Morbid Anatomy of Contracture in general.

Few opportunities have been afforded me of investi-

gating, by dissection, the organic alterations in articulations contracted during many years, by causes that have operated at a distance from the articulations. It is regarded almost as an axiom in pathology, that if any portion of the frame remain long in a state of inactivity, it will at length become so changed in its structure as to be incapable of resuming its functions. The application of this doctrine to contracted articulations has led to the assumption that, after the lapse of an uncertain period, the synovial surfaces undergo a gradual change of structure, the secretions become vitiated and diminished, and that adhesion of the articular surfaces, and, finally, complete ankylosis, result. I shall hereafter relate some circumstances which invalidate the accuracy of this opinion. I have already expressed my disbelief in the production of ankylosis simply from a state of rest. The prevalence of the error is in part attributable to the absence of discrimination between joints rigidly contracted and immovable by disease within or among the structures of the joint itself (ankylosis), and those contracted from causes operating at a distance, and consequently in an indirect manner only on the joint, constituting contracture. With the assistance of this distinction in the characters of contracted joints, observable during life, the morbid anatomist would neccssarily seek, after death, for organic alterations in the first class of cases, and would infer the absence of similar lesions in the second class.* It is not impossible that an articulation, rendercd inflcxible from the causes of contracture, may, although not primarily damaged, subsequently become subjected to the operation of causes capable of injuring the integrity of the tissues. Thus the muscles surrounding the articulation may possibly, by reason

* "Il faut bien distinguer la *rigidité articulaire* de l'ankylose, qu'elle simule. . . Si les malades succombent, on est tout surpris de trouver les surfaces articulaires intactes, alors qu'on croyait à une réunion solide des os."—Cruveilhier, *Anatomie Pathologique*, liv. 34. (See note, p. 104.)

Fig. 40.

Contracture of right knee at right angle, from paralysis. Posterior aspect: *a*, femur; *b*, portions of muscles arising from posterior part of internal condyle; *c*, ditto from external condyle; *d*, posterior part of articulating surface of internal condyle; *e*, ditto of external condyle; *f*, *g*, *h*, *i*, *k*, muscular attachments to tibia and fibula; *l*, fibula; *m*, posterior surface of tibia; *o*, *o*, corresponding divided portions of capsular ligament; *p*, *q*, muscular attachments; *r*, *s*, tense crucial ligaments.

Fig. 41.

Contracture of the right knee-joint, from paralysis, rigid at a right angle. The external aspect: *a*, the articulating surface of patella; *d*, internal condyle; *e*, external condyle; *t*, tense external lateral ligament, resisting replacement; *m m m*, anterior surface of tibia, rotated outwardly; *l l*, fibula.

of the contracture, act so unequally on the articular extremities, that the reciprocal adaptation of one bone to another may be destroyed, and the investing cartilage suffer from the effects of friction, and abrasion result. But although the possibility of this occurrence cannot be denied, the restoration to function of the largest articulations of the frame after long-continued contracture leads strongly to the conclusion that these secondary lesions do not take place.* The preceding figures (figs. 40, 41, pp. 130, 131) represent the anatomical condition of a knee-joint which had for twenty-five years been rigidly flexed from paralytic contracture.†

You will perceive from this preparation that the only perceptible alteration from the normal condition of the articulation consisted in structural shortening of the external lateral and the crucial ligaments. This was sufficient, after removal of the resistance of the muscles, to maintain flexion of the articulation: but gentle pressure with the hand demonstrated the elasticity of these ligaments, and that the shortening of their fibres was inadequate to prevent straightening of the articulation on application of very moderate force. The relation of the tibia to the femur was that of outward rotation on the perpendicular and transverse axes, as in *ankylosis*. The influence of the crucial ligaments, when shortened from long-continued flexion of the articulation, in maintaining and

* In incomplete ankylosis the effects of friction are often visible, probably in consequence of the previous disease of the articulation having diminished the resisting powers of the articular surfaces.

† I am indebted to the kindness of Mr. Gay for the use of the preparation from which the drawings are taken. This gentleman's report of the case is as follows: "W. R., ætat. 26, died of fever at the Royal Free Hospital in September 1840. He was born with perfect use of the limbs, but at the age of six months lost the use of the right lower extremity (from bad nursing), according to the report of his friends. He did not afterwards shew any disposition to use that limb, and until the time of his death walked upon the other leg and a crutch. The knee-joint became *perfectly fixed*, the leg and thigh being at a right angle."

probably in increasing the above rotation, may be studied in this figure. It appears incontestable that the peculiar arrangement of these ligaments (see *r*, *s*, fig. 40), their direction from the posterior part of the tibia and external portion of the fibula to the anterior and external surface of the internal condyle, favours the rotation of the tibia, on which, owing to its practical importance, I have so much insisted in the lectures on deformity from angular knee-ankylosis (pp. 78, 84). Other opportunities of examining eontractures after death have afforded the same results.

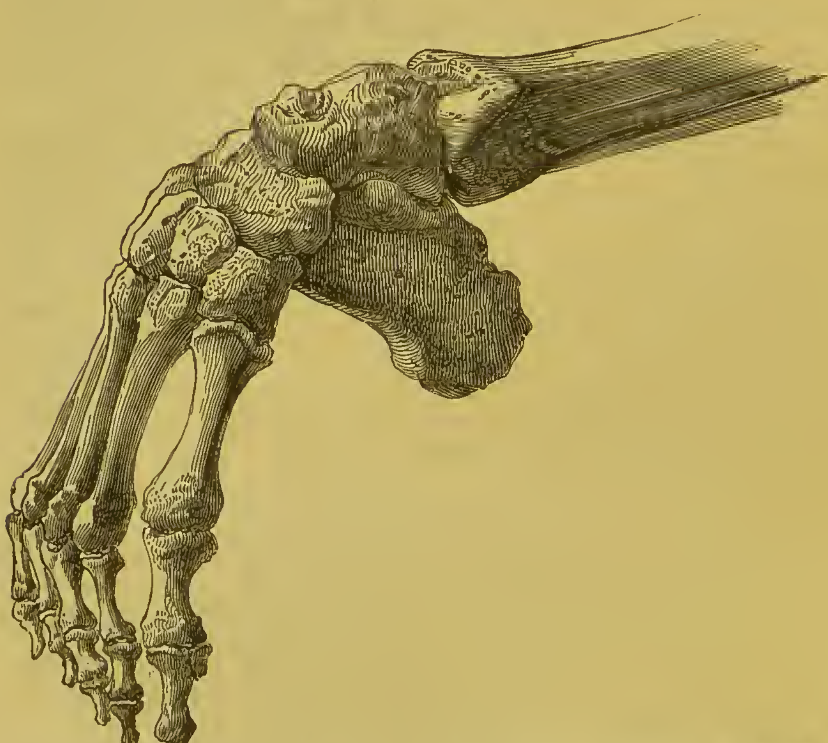
[The London Hospital Museum contains a dry preparation of the bones of a foot in the position of extreme Talipes equinus, probably derived from a subject who had, during a long life, laboured under paralytic or spastic foot-contracture.

The ordinary form of the foot affected with this distortion suggests at once that it cannot be accompanied with any irremediable deviation from the natural form and arrangement of the tarsal bones. The preparation in question (fig. 41) shews the deficient development of the osseous framework in all its parts, but no positive displacement or dislocation of any particular bone. Owing to the extended position of the foot, the surfaces of the astragalus, which should articulate with the tibia and fibula, are exposed upon the dorsum pedis, and, as well as the articulating surfaces of the tibia and fibula, have lost much of their natural smoothness in consequence of little or no motion having taken place between them. The os calcis during life-time had been drawn so much upwards behind the tibia as to have touched it; consequent upon which, a new articular surface is visible upon the superior part of the calcaneum, close to the articular surface for the astragalus. The dorsum pedis is much more convex than in a natural foot, owing to the scaphoid, together with the cuboid, cuneiform, and metatarsal bones being drawn towards the sole; hence

the round head of the astragalus is exposed, instead of being covered with the hollow of the scaphoid bone, as in a healthy state. The individual bones are imperfectly developed or have undergone atrophy.

The altered position of the bones in T. varus is more complicated than in T. equinus, which might have been expected on a comparison of the symptoms of the two diseases in the living subject. Non-congenital Talipes varus presents us with all the anatomical characters of T. equinus, with the addition of others which depend on the adduction and rotation of the foot. The os calcis is drawn upwards;

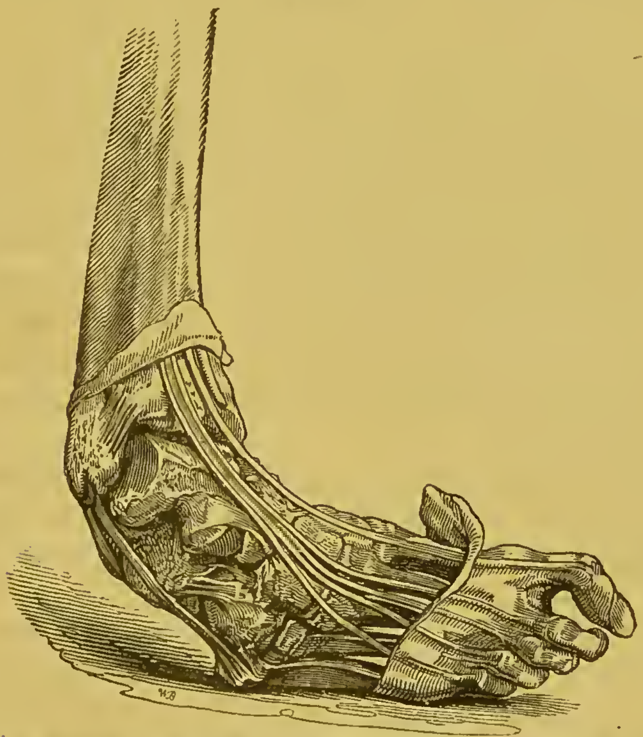
Fig. 42.



Arrangement of bones in non-congenital Talipes equinus. It represents the probable anatomical disposition of the bones in cases such as fig. 38. The extreme incurvation of the sole had resulted from the protracted contraction of the plantar structures, favoured by the individual never having applied the sole to the ground. Use of the foot could only have been obtained by walking upon dorsal surface of tarsus and metatarsus. The subject of the preparation had effected locomotion with the assistance of a wooden leg applied to the knee.

the tibial articular facets of the astragalus and its round head are exposed upon the dorsum of the foot (figs. 43, 46, and 47); but the scaphoid, cuboid, cuneiform, and metatarsal bones are not merely drawn towards the sole, but also inwards and upwards, so that the innermost point of the

Fig. 43.



*This drawing represents the preparation of the bones and muscles of the right foot of an adult female affected with contracture similar in form to congenital Talipes varus.** No history of the case could be obtained. It is doubtless the result of non-congenital spastic deviation of the foot. It may be relied on in the study of the anatomical characters of this distortion; as, from the evaporation of the spirits of wine from the jar in which it had been preserved undissected, it was completely dried up, resembling the foot of a mummy. From this circumstance the author was enabled (by soaking the external part of the foot in warm water, and by subsequently removing as much of the shrivelled skin and fascia as was necessary) to expose the bones for examination without the slightest alteration of the relative position of those of the tarsus having taken place since death.

* In the first edition of *Treatise on Club-foot, &c.*, the author proposed to employ the term Talipes (previously applied to varus only) as a generic one, to include all the varieties of foot-deformity produced by muscular contraction. His example has been followed in general use. Talipes therefore includes *contractures* and *congenital distortions* of *feet.*

navicular bone occasionally touches the internal malleolus, and has an articular surface formed on it, occasioned by constant friction (see fig. 43). The superior or external surface of the os cuboides is somewhat separated from that of the os calcis; whereas the plantar surfaces of these two bones are turned towards each other, leaving a triangular space between them externally. The course of the tendons of the muscles situated upon the front of the leg is consequently much altered. Those of the tibialis anticus, extensor proprius pollicis, and ext. long. digitorum, more particularly the first of these, are deflected so much internally, after passing over the ankle-joint, as to serve by their action to increase the deformity in the living subject (see fig. 43).

The morbid anatomy of the muscles and ligaments in contracture may be summed up in the evidences of structural shortening, atrophy, and degeneration, presented in common with other long-standing distortions already described, p. 17.]

In addition to the testimoy nderived from pathological anatomy, the result of the application of curative measures proves the absence of organic alterations in joints affected with contracture. From examination of the numerous models around you, representing limbs affected with these deformities, and their condition after the cure, you will comprehend the important fact, that articulations which, during twenty or more years, have been rigid, almost immovable, and wholly unserviceable, through contraction of the surrounding structures, may, on removal of the contraction, be restored to their functions.

Treatment of Contractures in general.

A little reflection on the pathology of contractures will suggest to you the indications of treatment. When certain muscles are spastically contracted, and the contracture is recent, the resources of medicine available in spasmodic

diseases in general must be resorted to, counter-irritation to the spinal column, laxatives, mercury, iodine, iron, arsenic, &c. You will bear in mind the tendency to structural shortening of muscular fibres and other tissues, and adopt those means of preventing this result of continued contraction which I have already described (pp. 49, 51, 73).

The indications in contractures of long duration are several. You have, in the first place, to remove the structural shortening of muscles by mechanical extension or by division, as in the treatment of deformities from articular disease; secondly, you have to effect the replacement and mobility of the parts; and, thirdly, to restore the power of volition in the debilitated muscles as well as in those which preponderate. [In some contractures, spasmodic action of the implicated muscles exists without structural shortening, as in certain cases of wry-neck (p. 119), in hysterical contractures generally, and often in Talipes. On failure of medicinal and general treatment, the question of the propriety of having recourse to subcutaneous tenotomy arises. In some distortions the aid of the operation is needed for the purpose of preventing secondary deformity, such as that which is apt to arise in the growing person from walking upon a limb in a distorted position. But a liability to relapse, or to the occurrence of a deformity of an opposite kind, should not be overlooked (p. 148-9). In general, however, in accordance with the rules already laid down, tenotomy is only advisable when structural shortening of muscle, insuperable to legitimate mechanical treatment, exists.* The question is sometimes to be determined *by the surgeon who is practically experienced in the employment both of mechanical and operative treatment*, taking into consideration the relative amount of pain endured, and time employed in the two methods.] The means specially applicable to the individual contractures will occupy the next lecture.

* For the mode of performing subcutaneous division of sterno-mastoid, see Congenital Wry-neck.

LECTURE IX.

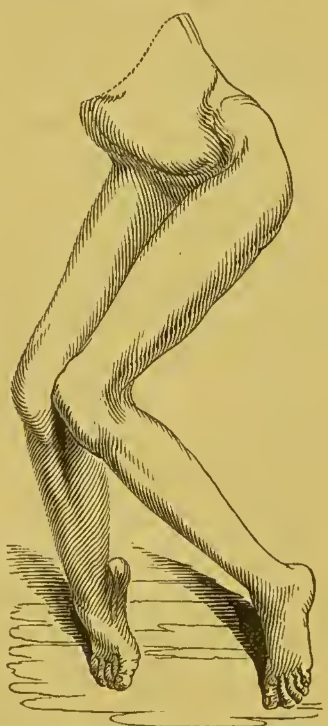
Characters of spastic rigidity of muscles and deformity in infants, young children, and adults — Treatment — Spastic deformities of ankle — Non-congenital club-foot ; origin, symptoms, and treatment — Spastic contracture of hand and arm — Universal paralytic deformity of upper and lower extremities — Treatment — Value of tenotomy in contracture of elbow and wrist.

THE first contracture which I shall consider is that resulting from universal rigidity of the muscular system, or of the flexor muscles only, in new-born infants; a condition analogous to *trismus nascentium*, a common disease in certain tropical countries.

In some instances the rigidity of the limbs is immediately apparent, in others it escapes observation during several weeks or months, or the spastic rigidity becoming complicated with structural shortening of the tissues on the contracted sides of the articulations, the nurse observes that she is unable to wash and dress the infant with the ordinary facility. The knees cannot be properly separated or depressed. Sometimes the trunk is stiffened, so that the infant is turned over in the lap "all of a piece," as the nurse expresses it. Occasionally the head is habitually retracted, and the elbows and wrists participate in the inflexibility. Very frequently the contracture is confined to the lower extremities, but more rarely to a single limb. The infant is observed invariably to sleep with the knees firmly approximated to the abdomen and to each other, and the toes inverted. As the child approaches the period at which the first attempts at standing and progression should be made, it is observed to make no use of the limbs; a consultation with the medical practitioner ensues, and a paralysis is sometimes pronounced to exist. In cases

where the sensorial part of the brain has suffered conjointly with the medulla spinalis, the intellect may even thus early be observed to be less developed than usual. The inability to stand or walk continues until perhaps the age of three or four years, when, with assistance, the child contrives to support himself. It is now ascertained that the soles of the feet are not properly applied to the ground, that the knees always incline inwardly, and that they continue bent. The child at length effects locomotion unassisted; but he cannot be said to walk, as his movements are characterised by an inability to stand still and balance himself erect. In the endeavour to do this he commonly falls, and to avoid this accident requires to continue in an imperfect running until he meets an object against which he can support himself. Being unable to bend the ankles, the toes strike against the smallest irregularities on the surface, occasioning loss of balance and frequent falls. In process of time greater certainty and ease in locomotion may be spontaneously obtained.

Fig. 44.



Mode of progression in an adolescent affected with congenital spastic rigidity.

[The child often manifests uncommon sensitiveness to impressions; even when approaching adolescence, he is alarmed at trifling noises. The sleep is usually light, easily disturbed. This nervous susceptibility often reminds the observer of the condition of a tetanic patient.

The inability to stand or walk firmly is due in part to shortening of the gastrocnemii and other muscles, the individual being, through the consequent elevation of heels,

deprived of the extensive basis of support afforded by the planta pedis, and in part also to the deficiency of volition exercised in the muscles concerned in progression. In many morbid states of the nervous and muscular systems a similar inability to perform slow, measured, or steady action of muscles is manifested ; a greater amount of nervous power being requisite to perform a single, complete, well-ordered action than to effect a number of incomplete movements. Thus, in lameness generally, when independent of physical obstacle or considerable paralysis, progression is *quickly* affected. In "nervousness," in stammering, in chorea, in delirium tremens, in fever, a similar condition exists. Aberrations of the mental power present analogous conditions, and are often coexistent with aberrations of volition. The *relaxed*, enfeebled intellect more readily originates a number of thoughts than carries any one of them to completeness.]

The same form of contracture may be produced later in life, during dentition, or during any of the numerous diseases of infancy, which excite much general disturbance. I have treated two cases in adults in whom the spastic state of the muscles resulted from direct mechanical injury applied to the spine; and two others, in which the universal contracture of the lower extremities resulted from disease, and deformity of the vertebral column.

You will remember that a single member may be thus affected ; the case is still less unfortunate when the contracture does not involve the hip-joint, but is confined to the knee and ankle.

Treatment of general spastic rigidity.—During the earlier months of existence you can resort to few therapeutic measures. I have usually contented myself with directing the nurse several times daily to endeavour to straighten the flexed articulations ; and this may generally, after a little perseverance, be accomplished, the object having been to prevent structural shortening of the spastic muscles. But from the observation of the utility, at a later

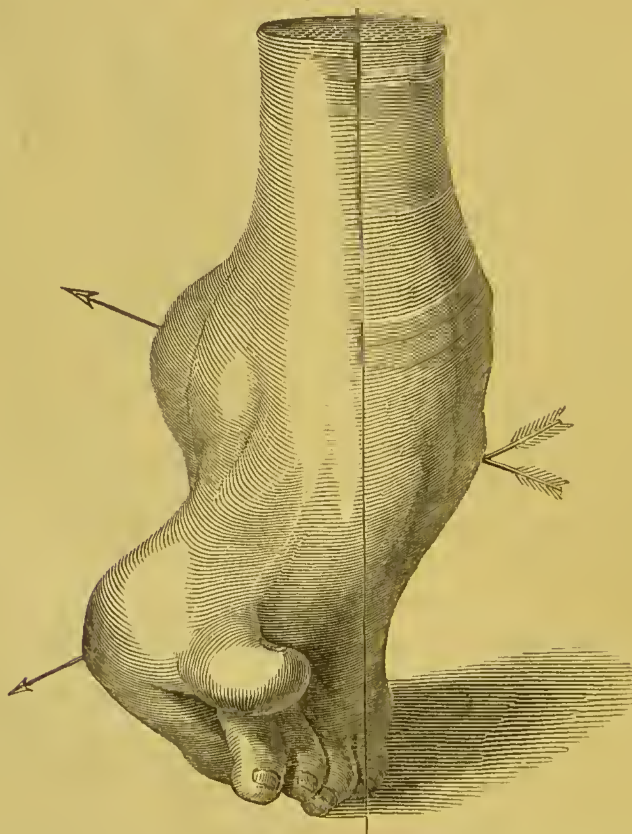
age, of counter-irritation to the vertebral column, I am induced to recommend you to try the use of stimulant embrocations to the back. Of course you will not neglect attention to the digestive organs, the proper action of which is of equal importance in health and disease. From the age of twenty months and upwards, I have employed more active counter-irritation to the neck and loins, lytta, potassa, and repeated small issues produced by argentum nitratum. You may endeavour, by appropriate mechanical apparatus, such as that requisite in deformities from other causes hitherto considered, to effect elongation of contracted parts; but the primarily spastic nature of the muscular contraction will prepare you for greater resistance, and perhaps convince you of the hopelessness of the attempt to effect mechanical elongation. It will, however, in many cases be evident that the primary cause in the nervous system has subsided [or the muscular fibrils have undergone transformation], and that you have structural shortening alone against which to contend. Failing manipulations, instruments, and the remedies directed against the cause of the contraction resident in the nervous system, you still have tenotomy as a *dernier ressort*; and this, in the majority of instances, will not disappoint your expectations (p. 137).

Fig. 45.

Non-congenital spastic contracture of hips, knees, and ankles. When unassisted by art, the individual, with advancing years and increasing weight, becomes less able to effect locomotion without crutches.

The parts requiring section here may be the adductors of the thighs, the hamstrings, gastrocnemii, and adductors of the feet. I can scarcely limit the age at which this operation may not be productive of benefit. There is the drawing (fig. 45) of an adult upwards of thirty years of age, who had never walked, but who acquired sufficient power, after tenotomy and straightening of the limbs, to walk with the assistance of a stick only. Several similar cases have been observed in in-patients at the institution. The diag

Fig. 46.

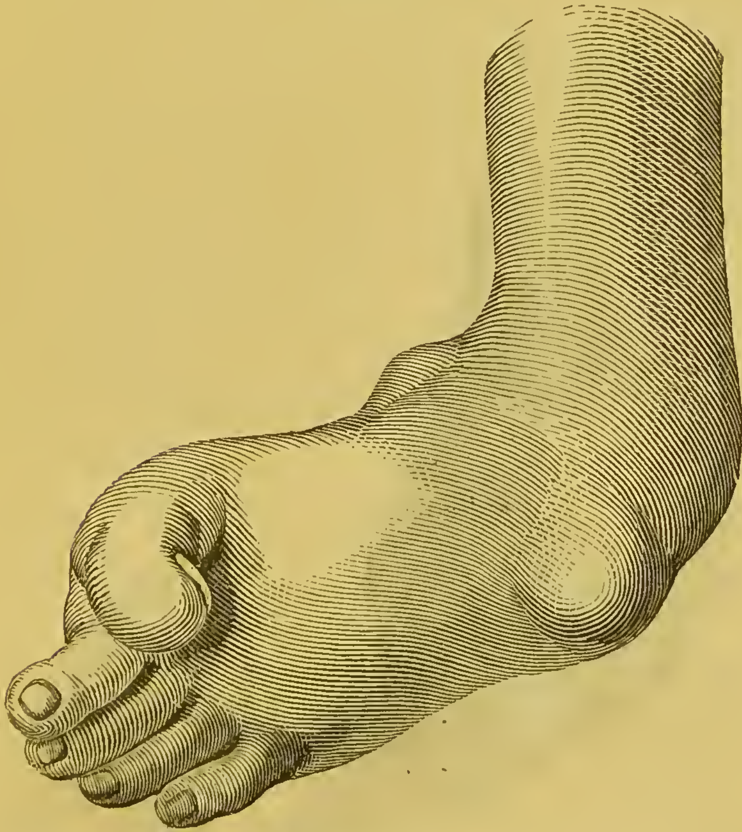


Non congenital spastic contracture. T. equino-varus. The arrows indicate the direction of the convexity of the tarsus and metatarsus, forwards and outwards; the perpendicular line through the axis of the limb shews the extent of the inward deviation of the metatarsus, by which the base of the little toe, being brought completely beneath the axis, has to support the entire weight of the body in walking. Completely restored by section of T. achillis and mechanical treatment. For *minute* details of treatment, the reader is referred to *Treatise on Club-foot*, 1st edition, Appendix, Case XIII. The individual has remained quite well.

nosis of these spastic contractures from paralytic contractures rests upon the presence of volition in every muscle. It is necessary to be careful also not to confound them with similar deformity from disease of the articulations.

Thus far I have principally dwelt on spastic contracture of the hips and knees. The corresponding affections of the ankles are more common. As I have already men-

Fig. 47.



The left non-congenital spastic Talipes varus of a lad aged 16, *in whom both feet were similarly affected.* The disease commenced in infancy, was accompanied by contracture of the knees; but the deformity did not attain the degree here represented until he had a severe attack of fever, in his eleventh year. He had never been able to walk, in consequence of the contraction of both the knees and ankles: thus the feet presented pure specimens of non-congenital T. varus, from the anormal position of the bones of the tarsus having undergone no increase by the action of walking. The muscles had been able (unchecked by remedial means) to exercise their full power of producing deformity. The globular prominence visible upon the instep arises from the exposure of the round head of the astragalus, the navicular bone having been drawn from it both inwards and upwards.

tioned, they invariably accompany the contractures of the hip and knee, though they often occur independently of them, and constitute the spastic forms of non-congenital talipes, or club-foot. Figs. 46-48.

The most simple form is that consisting of abnormal spastic elevation of the heel, causing the individual to walk

Fig. 48.

The posterior view of the foot represented fig. 47.

on the toes only; or the deformity may be combined with some inversion of the toes, as in fig. 46. A complete varus (figs. 47 and 48) may result from the spastic contraction of

the adductors of the foot conjointly with the gastrocnemii.

It is necessary that I should impress upon your attention the mode of origin of many of these cases of deformity, as errors of diagnosis are in this respect not uncommon. In adults the attack can usually be traced to an epileptic, hysterical, or chorea-like seizure; in children the deformity succeeds to an attack of convulsions, but more commonly the origin is unperceived. It is often stated by the parent to have been an injury sustained whilst at play; whereas inquiry elicits the fact that the deformity had not for its cause an origin of that nature, but arose from disturbance of the nervous system. It is evident that in many instances the muscular contraction comes on insidiously, and does not attract attention until some trifling accident at play, as a fall (induced probably by the gastrocnemii being already partially affected with spasm, and imperfectly under the child's control), leads to an examination of the limb; from which period the increase of contraction and deformity becomes anxiously watched. In the remarks on spasmodic contractures in general, I mentioned that when the contraction is gradual, the remote cause often consists in chronic derangement of an organ affecting a peripheral part of the nervous system. There exists, in my opinion, no cause more frequently productive of these spastic contractures of the ankle than derangement of the mucous membrane of the alimentary canal, indicated by worms, diarrhœa, or other symptoms of gastric or intestinal morbid sensibility. This disturbance may continue a considerable time unheeded, or without suspicion of its tendency to induce secondary disease being awakened. By means of the chain of filaments on which the reflex functions of the nervous system depend, it may be unobtrusively exciting involuntary contraction, evinced by a scarcely perceptible limp, a tendency to fall, or a certain wayward action in walking. At this period it frequently happens, that if the foot be

examined when not actually engaged in walking or standing, no abnormal condition can be perceived (unless perchance a slight diminution of the bulk of the limb already exists); for Stromeyer has shewn, and you will have frequent opportunities of verifying the observation, that it is characteristic of this affection of the gastrocnemii (previously to its acquiring the highest grade, and having existed a considerable period when atrophy commences), to be excited into activity, or much augmented, when the sole of the foot touches the ground, as in walking. This may remind you of the effects of irritating or touching the web of the frog's foot, or the skin of the sole of the rabbit, when the excitability of the muscles is increased by narcotism or decapitation, or the influence of volition removed. The membrane and skin covering these parts are, like the skin of the human sole under certain circumstances of disease, more particularly susceptible of external impressions, and when irritated, capable of producing reflex muscular contractions.

You may bear in mind that impaired nutrition of the frame, whether it result from disease in an organ, or be the direct consequence of deficiency of food, is one of the most active predisposing causes of these deformities, as of chorea and the whole of the neuroses. Raphania, a disease not unfrequently witnessed in those parts of the continent where rye-bread is the principal food of the people, is accompanied with spasmodic contracture of the lower extremities; hence it has been denominated the cripple disease. The older authors have attributed raphania to the poisonous action of secale cornutum; but it admits of doubt, whether the symptoms may not in great measure be referrible to imperfect nutrition [consequent upon the use of the deteriorated article of diet]. In the oriental disease beribery, in which spastic rigidity of the limbs constitutes so important a symptom, the patient, after subsidence of the acute symptoms, remains affected with spastic contracture.

I have recently (1841) relieved, by tenotomy, a gentleman who had been totally incapable of locomotion from this disease, contracted during a residence in Ceylon many years since.*

The treatment of these spastic contractures of the ankle,

* The opportunity of studying this interesting case was furnished me by Dr. Hoskins of Guernsey. The feet were in the position of extreme Talipes equinus; the patient used crutches, and appeared hopelessly paralysed. Notwithstanding the uncommonly rigid tension of Achilles tendons, and subsequent complete depression of the front of the foot, a slight tremulous action of anterior muscles of ankle was perceived, which suggested the possibility that the case originally might have been spastic loss of use of limbs, instead of paralysis, or spastic contraction succeeding to that graver affection, as in the case narrated p. 126. The Achilles tendons were at once divided; for trial of mechanical means, unaided by tenotomy, was, in the case of limbs presenting the bulk and rigidity of the present case, quite out of the question. In a few weeks he was able to walk without crutches.

The following letter will shew that the relief has been permanent:

Guernsey, December 2d, 1852.

My dear Sir,—It gives me great satisfaction to inform you that Mr. **** derived the greatest benefit possible from your . . . . treatment. He can now stand, amusing himself at his lathe, during the livelong day, and can take a walk of four miles, over indifferent pavement, without inconvenience or experiencing fatigue. His left foot turns out; but this is *confessedly* ascribable to his not following your injunctions, after he left you, as strictly as he ought to have done.

I have shewn him your note, and he requests me to state a fact of which I was cognisant before he went to London, that there was no degree of paralysis whatever associated with his infirmity. He could by the aid of his toes propel himself from room to room in his wheel-chair. He also says that the complaint under which he laboured in Ceylon, and which gave rise to the contraction, was not beribery, which is accompanied with a swelling of the extremities analogous to elephantiasis (?). He never had any swelling.

The original attack was a singular one: I have never been able to make it out to my own satisfaction. The exciting cause of the contraction was snipe-shooting in the rice-grounds, up to his knees in water, with a tropical sun shining on his head for hours.

I am, my dear sir, yours very sincerely,

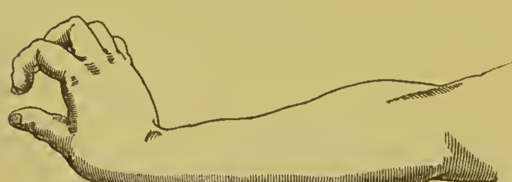
J. Elliott Hoskins.

This communication confirms the prognosis as to the absence of paralysis. A doubt exists, whether the affection resulted from beribery or some other form of affection of medulla spinalis from tropical exposure. See Mason Good's *Study of Medicine*, vol. iv. p. 493, 3d edition.

so long as they present a probability of removal by the general and mechanical means, should be conducted on the principles already laid down; and when the assistance of tenotomy becomes requisite, the section of those tendons only which offer the greatest resistance should be accomplished, viz. the gastrocnemii, with or without the adductors of the foot (anterior and posterior tibial tendons), according to the peculiar abnormal form of the member. In those cases in which the ligaments do not retain the limb in the old position, you will often find that after the operation the antagonist muscles forcibly endeavour to distort the foot in the opposite direction. It is therefore important to secure the foot, by means of splints, in the primary deformed position, to prevent too great elongation of the divided tendons. The deformity can be gradually removed by subsequent mechanical means, and the functions of the limb be partially or completely restored by the same after-treatment described in the lecture on deformity from ankylosis.

Spastic contracture of the upper extremity rarely occurs independently of contracture in the lower limbs. The causes are the same. It affects commonly the pronators and flexors of the wrists and fingers (fig. 31, p. 109), sometimes the biceps, pectoralis major, latissimus dorsi, teres major and minor. [Occasionally the extensors or the flexors only are contracted, fig. 49 and fig. 50.] The treatment should be based on the same principles as that necessary in the corresponding affection of the lower limbs. I would not advise you hastily to resort to tenotomy in these cases.

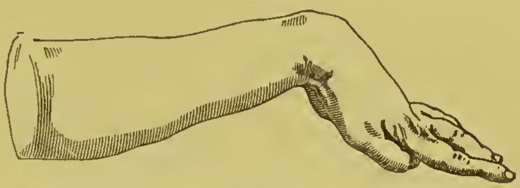
Fig. 49.



Spastic contraction of extensors of wrist. The extensors of fingers either unaffected or incapable of overcoming the flexors of fingers; the wrist therefore is extended, whilst the fingers are flexed.

I shall defer the consideration of the operation, until I have spoken of paralytic contractures.

Fig. 50.



Spastic contraction of flexors of wrist. The flexors of fingers being unaffected, the corresponding extensors, being stretched in passing over wrist, maintain extension of fingers.

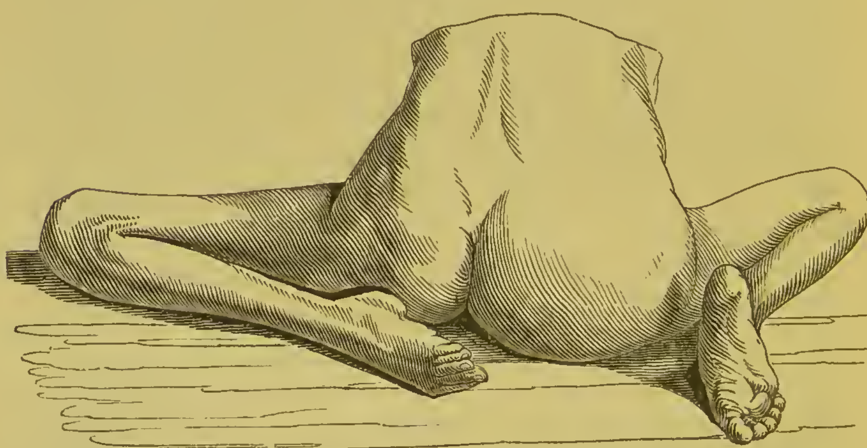
[In concluding the treatment of spastic contractures, it may be repeated, that tenotomy is only to be resorted to as a *dernier ressort* on failure, of mechanical treatment. In spastic contracture tenotomy is only available as a rude means of mechanically defeating the persistent active contraction of the deranged muscles. Sometimes, even when deformity in the opposite direction does not result, the relief is not permanent; for if too great shrinking of the intermediate tissue which unites the severed ends should ensue, return of the original deformity may be expected.

In those cases, however, in which the spastic contracture has existed many years, structural shortening of the muscles. and tendons will have supervened, the muscular fibrillæ will have become more or less disorganised; so that whilst the structural shortening will have rendered tenotomy more necessary, the disorganisation of fibre will have rendered re-contraction less probable.]

Universal paralytic contracture of the lower extremities presents, at first view, considerable resemblance to the spastic affection of the same parts. It arises at various periods of infancy, the organic disease of the central organ of the nervous system being preceded or accompanied by disorders of dentition, intestinal derangement, hydrocephalus, fevers of various kinds, and universal debility. A perfect paraplegia or hemiplegia, occurring gradually or suddenly [sometimes in the night, without previous indication of indisposition], are frequent precursors of this contracture. In the

study of the origin of these contractures it is apparent that in many instances the paralysis affects particular sets of the muscles; the non-paralysed muscles slowly contract, and produce deformity. In other instances all the muscles are paralysed *quoad* volition; but the greater mass and power of the flexors and adductors, acting through the involuntary contractility of the fibres, distort the limbs. Such patients, affected with universal contracture, present deformity of hips, knees, and ankles; the principal muscles that appear contracted are the tensor vaginæ femoris, rectus femoris, the ham-string muscles, the gastrocnemii, and adductors, the

Fig. 51.

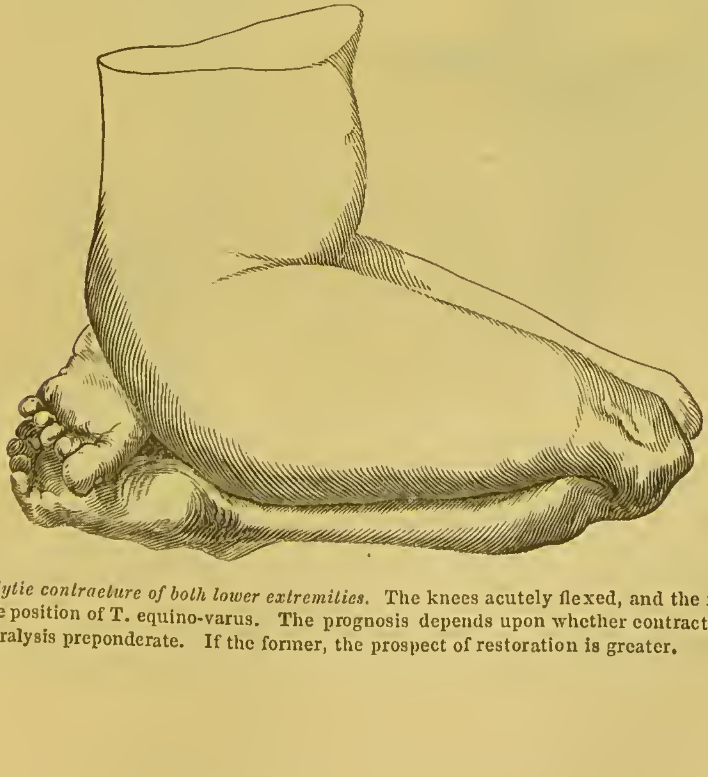


Paralytic contracture of right lower extremity. The left member totally and helplessly paralytic without contracture. The case originally complete paraplegia. The more favourable nutrition of the less affected side is conspicuous.

remaining muscles being wholly paralysed. The models around you will illustrate the appearance of these patients; they are compelled to effect locomotion entirely by the action of the arms, using for this purpose crutches, or move from place to place on a wheeled carriage, in the manner frequently displayed by mendicants in the streets of the metropolis (fig. 51). As I have before mentioned, a single limb or joint may be affected with paralytic contracture, and sometimes one limb presents paralytic and the other spastic

contracture, the deformity corresponding or not on the two sides. Thus, therefore, nature presents us with two series of deformities nearly identical in external appearance, and your tact as practitioners in diagnosis and prognosis will often be tested. You will at once comprehend that paralytic contractures, on the whole, are the less favourable for treatment. Still, immense advantages are secured to persons thus afflicted, if you can so restore the form of the member that the patient may avail himself of a straight pillar on which to support the trunk. When the muscles on one side of the member only are paralysed, the adaptation of proper mechanical apparatus, with springs, in some degree to supply the place of the deficient muscles, will give the sufferer considerable tact and facility in locomotion. Several cases of extremely severe paralytic contracture, the individual never having walked, have, in this institution, been enabled to throw aside crutches and the arm-propelled carriages resorted to in the streets. When a single ankle

Fig. 52.

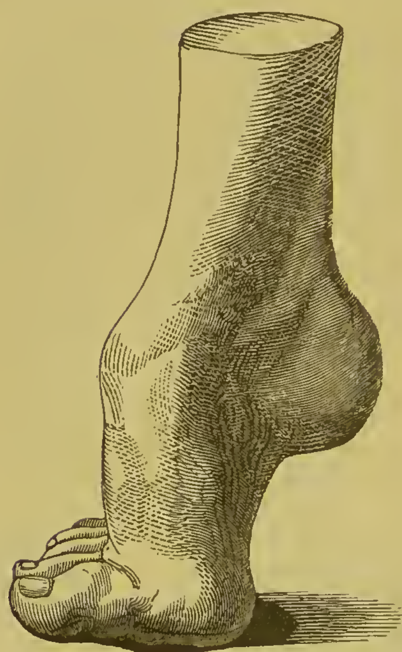


Paralytic contracture of both lower extremities. The knees acutely flexed, and the feet in the position of T. equino-varus. The prognosis depends upon whether contracture or paralysis preponderate. If the former, the prospect of restoration is greater.

and knee are affected, the patient may be restored to a considerable extent, and perform the ordinary offices of life with little inconvenience.

[Paralytic contracture in a single articulation is well illustrated by the common non-congenital Talipes equinus, in which the heel is often elevated to the highest extent, the patient walking upon the anterior extremities of all the metatarsal bones, as in fig. 53; the deformity from a paralytic origin often equalling the severest spastic T. equinus. Complete or partial paralysis of anterior tibial muscles is the common cause of this contracture, the extensor muscles of the toes being either unaffected or but slightly involved in the paralysis. When the paralysis is more severe, distinctly affecting the extensors of the toes, these parts, instead of being extended, as in fig. 53, are flexed towards the sole, as in fig. 55, the individual being either precluded from using the limb or actually applying the dorsum pedis, *i.e.* the upper surface of the tarsus and metatarsus, to the ground (fig. 38). It is worthy of remark, that in certain cases in which the respective characters of paralysis and spasm are not well marked, a difficulty in determining whether the case has primarily depended upon paralysis or spasm may arise. In general, there is something in the aspect of the case which, independently of its history and of physical investigation, impresses the experienced eye with a certainty of its nature. Thus spastic

Fig. 53.



Non-congenital paralytic Talipes equinus.

cases, besides the superiority in nutrition and temperature, present often a bolder relief, whilst paralytic cases are distinguishable by a characteristic softness of outline.]

Paralytic deformity of the upper extremity is more serious; the member must be condemned to uselessness so long as one set of muscles is unaffected by volition. The movements of progression, performed by the lower extremities, are more simple and considerable; use of these parts is not incompatible with a certain amount of paralysis. A person can effect locomotion with a certain amount of comfort and satisfaction even when the *foot* is completely paralysed; but the functions of the hand are exceedingly

Fig. 54.

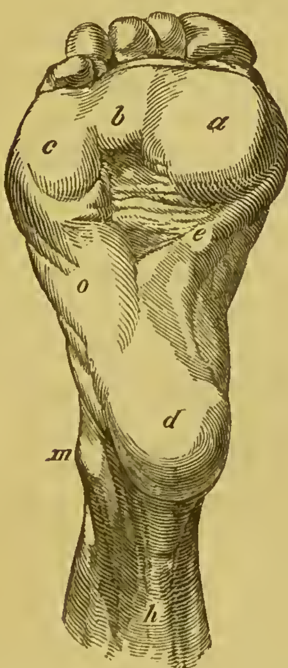


Fig. 55.

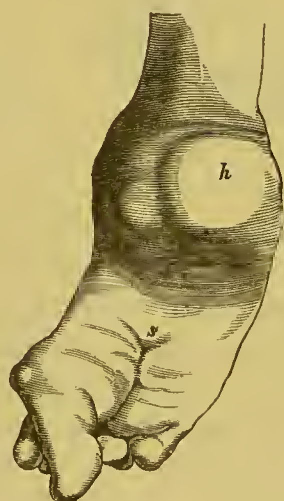
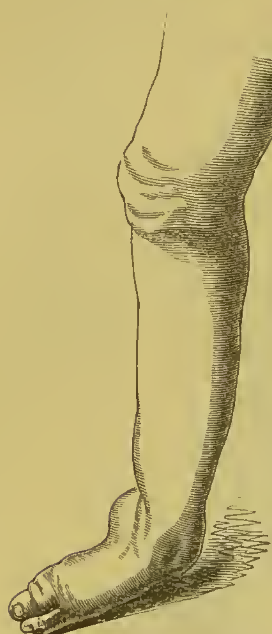


Fig. 54.—*The sole of a foot affected with non-congenital T. equinus.* The letters *a b c* indicate the situations covered with painful corns; o marks the position of the os cuboides, and *d* the under surface of the os calcis. The integuments investing these two bones have never touched the earth. The letter *e* indicates a ridge occasioned by the tense tendon of the flexor longus pollicis muscle and the internal edge of the thick plantar fascia; *m* marks the external malleolus; *h* the tense tendo Achillis.

Fig. 55.—*Non-congenital paralytic Talipes equinus.* Paralysis more considerable than in fig. 54; *h*, heel extremely elevated; *s*, deep furrow in sole, resulting from attraction to one another of all the plantar tissues, owing to the loss of their antagonists on the dorsum pedis.

complicated: each muscular fibril has its appropriate action and subserviency to volition, and requires to be balanced in its action by its antagonist; when, therefore, the supinators of the wrist, and extensors of the wrist and fingers, are paralysed, the functions of their antagonists are as completely arrested as if all were afflicted with a common calamity. This is, however, the proper place to caution you not too early to abandon a paralysed hand and arm as incurable; it frequently happens that during the continuance of the paralysis, contraction and structural shortening of one set of muscles (as in the leg also) takes place, and on the removal of the cause of paralysis resident in the nervous centre, the limb remains contracted. In these cases you may observe a germ of volition in the apparently paralysed muscles, and by manipulation, friction, exercise, mechanical support, and more rarely by electricity in its various forms, you may succeed in partially restoring the limb. I have witnessed cases of paralytic contraction of the arms and hands consequent on fever, wholly restored after considerable lapse of time by this treatment.

Fig. 56.



Non-congenital paralytic T. varus. The knee also paralysed, but with little contracture.

I shall conclude this lecture with a few remarks on the utility of sections of numerous muscles of the hand and arm, the substance of which has been elsewhere published by me. Unfortunately, the universal tenotomists, who behold in a contracted limb a mere piece of mechanism held in an abnormal form by certain unnaturally tense cords, have, without reflection on the etiology and pathology of these deformities, proceeded with the knife to relax the contracted part, regardless of the numerous conditions requisite for a

restoration of the function. In principle, subcutaneous tenotomy is equally applicable to the upper and lower extremities; but a wide difference exists in the application of the principle. The movements of the ankle consist, it is true, of flexion, extension, adduction, and abduction; but in the act of walking, flexion and extension are alone absolutely necessary, adduction and abduction being only required under extraordinary circumstances. Operative orthopædy is capable of restoring a contracted useless leg, and fitting it for the ordinary purposes to which, in the civilised state of society, it is applied, but cannot adapt it to the extraordinary use made of it by the athletes or the professional dancer. But in the case of the hand, every individual, from the day-labourer to the watchmaker, or the workman in the minutest branch of the arts, avails himself constantly, not only of flexion and extension, but of pronation and supination,—those movements which are analogous to the inversion and eversion of the foot. If you at the same time bear in mind that, notwithstanding the analogy in these movements of the upper and lower extremities, the acts of pronation and supination are far more delicate and elaborate than the analogous movements of the foot; if you remember that not only are the movements of the hand much more complicated, but that the several fingers possess each their allotted muscles and consequent functions, you will at once perceive, that although, in principle, orthopædic operations are equally applicable to the hands, the difficulty of applying the method must be immeasurably greater. The anatomical conformation of the arm and hand, the smaller space in which is accumulated a larger number of nerves, muscles, and tendons, the difficulty of dividing those which may be contracted, without disturbing or exciting unnatural adhesions with those which may be normal in their action,—all combine to retard the progress of orthopædy in this direction. Operations on the elbow are usually successful; in the hand also,

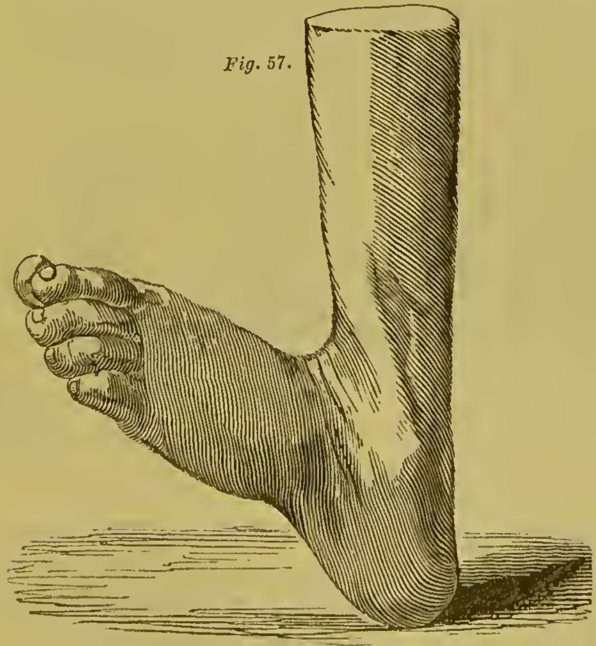
when merely unnatural flexion or extension exists, paralysis being absent, the functions of the wrist may be restored by tenotomy. Thus, at the Orthopædic Institution, I have treated cases of contracted elbow and wrist which have yielded perfectly, by section of the biceps or of the flexors, extensors, and pronators of the wrist, the functions having been more or less completely restored according to the cause of the contraction. I may briefly state the order of success in these cases to have been as follows: Organic shortening of the muscles from long-continued relaxation, as from accidental injuries and inflammation; congenital contraction; spasmodic contraction; contracture from abscesses, with loss of substance, gangrene, &c. The result of my observation leads me to assert, that how discouraging soever at the outset, contractions of the hand are not irremediable; on the contrary, that although few are perfectly curable, the great majority are susceptible of considerable benefit. Although the degree of restoration of function varies, yet in nearly every case that has come under my notice, the deformity (which alone frequently impels individuals of the upper classes of society to seek relief,) has been removed, and I have succeeded in enabling a person to write tolerably well. A wide field, however, remains open for future research and experience; and although I would strenuously discountenance all rash and wholesale division of tendons in these cases, I recommend the matter to the attention of those who are possessed of an intimate knowledge of the anatomy of the parts, and are endowed with a large share of patience to watch and elaborate results. The loss of a lower extremity is a great privation, but experience shews that the deprivation of the use of the arm and hand is felt as a far greater affliction; so much the greater, therefore, must be the reward of him who, by adding to the common stock of knowledge on the remedy of this infirmity, can so largely contribute to the welfare of his fellow-creatures.

LECTURE X.

Paralytic deformities of the foot, continued—Talipes calcaneus—Mode of origin and development of the deformity—Talipes calcaneo-valgus —Treatment—Section of peronei tendons—Value of removal of portion of tendo-Achillis and of cutis, to effect artificial contraction—Artificial talipes calcaneus in Chinese women—Paralytic talipes valgus; paralytic talipes varus—Table of these deformities. [Contractures from abscess, from sloughs—Contracture of lower jaw—Peripheral?—Spasm and peripheral paralysis].

HITHERTO, among the spastic and paralytic contractures of the ankle, I have not fully described an uncommon kind of deformity, talipes calcaneus (fig. 57), in which, through preponderating action of the anterior tibial muscle, the front part of the foot is elevated, the heel receiving the weight of the body. A similar deformity has resulted from the cicatrix of a burn on the front of the ankle, and

Fig. 57.

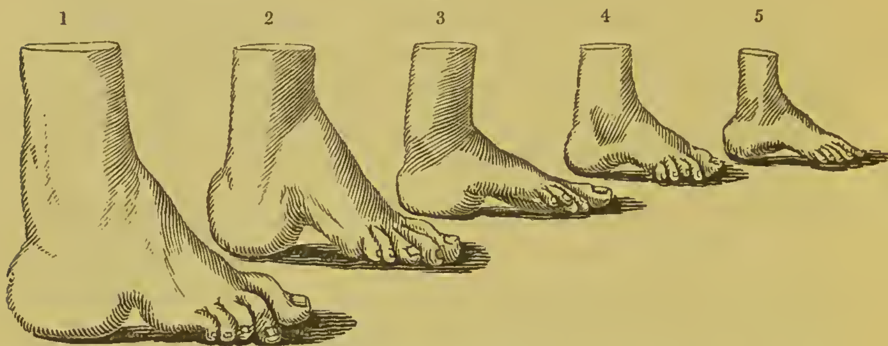


Talipes calcaneus in a child aged four years and a half.

consequent contraction of the cutis and subjacent tissues, by which constant abnormal bending of the foot has been produced.

You should not, however, imagine that the toes are always so completely elevated as in the model; in standing

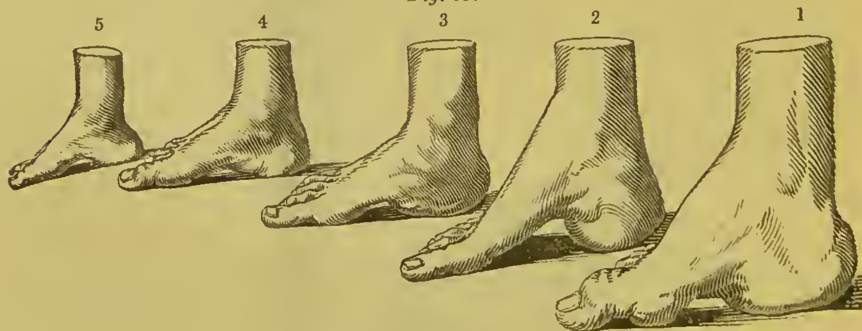
Fig. 58.



Series of figures of *Talipes calcaneus* from the highest to the lowest grades, viewed from the outer side.

they are often allowed to fall so as slightly to touch the ground, the heel receiving the principal pressure; but when the individual walks, the toes rise and become everted, producing a very unsightly gait. On examination you will

Fig. 59.



The same series seen from the inner side.

find the gastrocnemii imperfectly developed and relaxed, the tendo Achillis scarcely visible, often feeling flaccid and thin as a piece of tape, more or less unaffected by volition, sometimes completely paralysed.

This deformity, in its advanced grade, becomes modified, so that you might with difficulty recognise it in this series of models (figs. 58 and 59). When the most deformed of this series was first presented to my notice in 1836, I was much embarrassed to determine its nature, its precise pathological character.

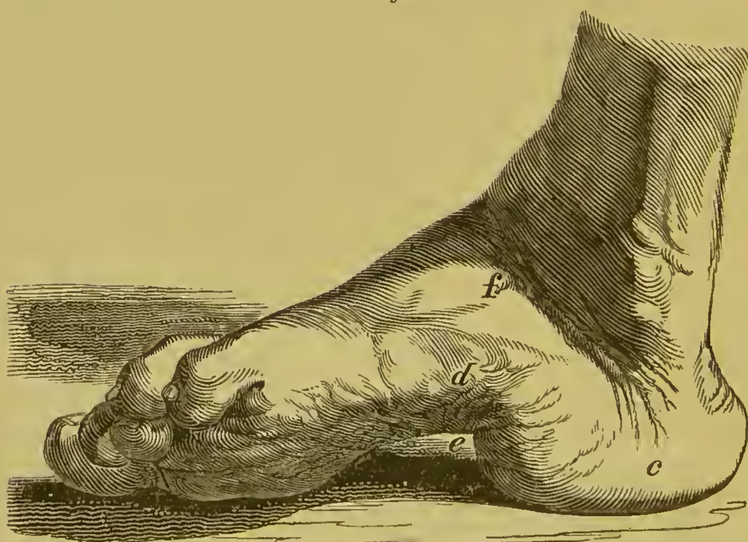
I regard this series of talipes calcaneus as worthy of attentive study, because it satisfactorily illustrates the manner in which secondary changes ensue on disturbance of the equilibrium in different sets of muscles. The essence of the disease consists in debility or paralysis of the gastrocnemii, and proportionate preponderating action of the anterior muscles of the leg. In walking, the individual possesses no power of elevating the heel, but may, by volition, permit the front of the foot to drop; besides which, the weight of the body propagated from the leg to the tarsus tends to depress the toes. The debility of the gastrocnemii may exist for a considerable time, until the commencement of deformity and increase of lameness excite apprehension. You will perceive that in the smallest model, from a patient aged six years (No. 5), the effect of treading exclusively on the heel is already manifested by considerable increase in size of the part; whilst the want of power in the gastrocnemii to balance the contractility of the muscular tissues of the sole is the mutual approximation of the tuberosity of the os calcis and the anterior extremity of the metatarsus, causing an augmentation of the concavity of the sole. The front part of the foot being inactive is arrested in its development and disproportionately small. The remaining models illustrate the increase of deformity with advancing age. No. 2 represents the foot of a young lady ætat. fourteen, and No. 1 that of a gentleman ætat. sixteen; the deformity has here attained its highest grade.

In both of these models you may study the operation of other muscles, which, although they may not have lost

their antagonists, increase the deformity by the alteration of their modes of action. The power of raising the heel is lost, but the peroneus longus, besides being an abductor of the foot, presses the great toe to the ground, and draws it back towards the origin of the muscle; its fibres then become structurally shorter, and by their continued tension occasion the deep cleft visible on the outer margin of the foot, where the tendon passes around the os cuboides previously to entering the sole. The augmentation of the convexity of the dorsum and hollowness of the sole reaches the maximum in these models.

In No. 3, figs. 58 and 59, the deformity, owing to participation of the anterior tibial muscle in the paralysis, is varied by the outer edge of the foot being entirely raised,

Fig. 60.



T. calcaneo-valgus seen from the outer side. c, outer side of heel, slightly raised from the ground in act of walking; d, middle portion of outer margin of foot, much raised from the ground, so that the light, as at e, may be seen beneath the sole;* f, hollow resulting from the astragalus having lapsed towards the inner side of the foot. The tense peronei tendons are visibly prominent behind malleolus.

* In this respect an exaggerated condition of that form of foot regarded as perfection. The eccentric Lady Hester Stanhope boasted that a mouse could run under her sole without touching it.

the peronei here being imperfectly balanced. To this form of the affection, through the peronei greatly everting the toes in walking, I apply the term Talipes calcaneo-valgus (see also fig. 39, p. 124, and fig. 60).

Now, the practical value of these remarks on the origin and progress of this deformity is, that it teaches us the importance of endeavouring early to arrest its course by attending to the primary paralysis. You will probably be surprised to know, that in every one of the patients from whom these models have been taken the disease was during infancy overlooked; and it is only by a comparison of these cases with those of still younger subjects affected with the paralysis and the incipient deformity, that I am enabled to describe to you its nature.*

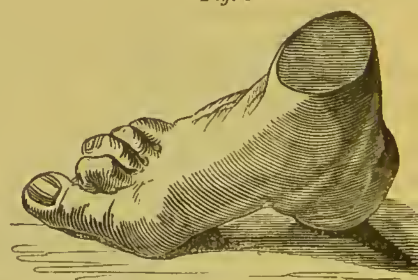
The "weakness" of the limb in each of these five patients was observed by the anxious parents, the best surgical aid was sought, and the subjects pronounced to have nothing the matter with them. In other cases the opinion given has been, that on completion of dentition the weakness would disappear. If hopes be raised on this expectation, you will, in the majority of instances, be disappointed. You should attentively ascertain whether any internal organ be injured, and maintain a disordered condition of the brain and spinal cord, exciting paralysis of one set of muscles, or abnormally increased activity of others. According to the nature of the case and constitution of the patients, test the value of purgatives, counter-irritation to the head or spine, iron, iodine, or liquor potassæ arsenitis, frictions and manipulations to the limbs, and the use of a boot and iron calculated to prevent bending of the foot, with a high heel to favour retraction of the gastrocnemius, or prevent its being reduced to a riband by the action of the anterior muscles of the leg. If the deformity should have reached the highest grade, it constitutes an almost intractable case. Section of the peronei tendons

* See West on Diseases of Infancy and Childhood, 1848.

and of the contracted plantar tissues may then afford some benefit as regards the deformity, if the treatment be followed by appropriate attempts to flatten the foot. In Talipes calcaneo-valgus the above section is still more serviceable, by causing the individual subsequently to walk on the outer edge of the foot as well as on the heel and great toe. This adds greatly to the patient's comfort, as before the section the inner ankle is continually prone to be projected inwardly, with the sensation of impending dislocation of the tarsus. It has been recommended, that as the tendo-Achillis in this deformity appears too long, you should remove a portion of it, and thus seek to produce contraction, or, more properly, shortening of the gastrocnemii. Now, if the description of the nature of the pri-

Fig. 61.

Fig. 62.



Figs. 61 *and* 62. *T. calcaneo-valgus before treatment.*

Fig. 63.

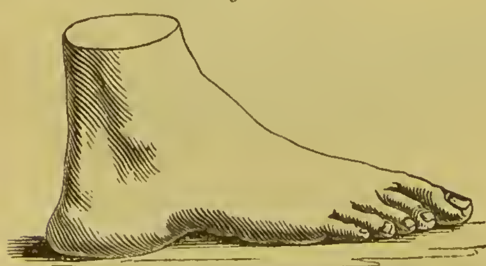
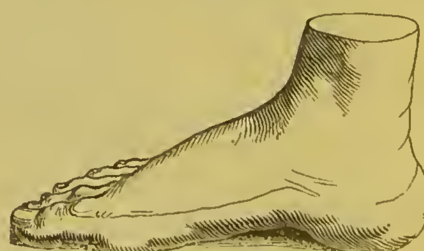


Fig. 64.



Figs. 63 *and* 64. The same case of T. calcaneo-valgus after treatment by section of peronei, plantar fascia, and removal (1840) of one inch of T. Achillis and a considerable portion of loose integument from posterior part of ankle-joint, and subsequent mechanical extension. The removal of portion of T. Achillis and integument has already been condemned in the text, on the grounds that the author had found section of peronei and plantar fascia sufficient, with prolonged mechanical extension, to enable the patient to tread more evenly.

mary lesion which I have given you be correct, benefit will not be anticipated from that proceeding; indeed, you will regard it as a worthless project, one not founded on pathological notions, but simply on mechanical ideas, on the mere regarding one tissue as too long, another as too short. I may take this opportunity of assuring you, that you can never treat a deformity with advantage to the patient or to your own satisfaction and reputation, unless you thoroughly understand the pathology of the case. Deformities have too long been treated as they have been regarded—as mechanical affections. I have, in former lectures, said enough to demonstrate that they constitute one of the most interesting branches of pathology. With respect to this operation of removing a portion of the tendo-Achillis, I ought to inform you that I have twice performed it, with some modification, on the principle that, if incapable of aggravating the patient's condition, a certain amount of physical contraction above the heel might possibly benefit the patient. We daily witness the effect of contraction of the skin, after burns and sloughs, in abnormally contracting various parts. It occurred to me that, if, together with removal of a portion of the tendo-Achillis, a portion of the loose skin above the os calcis were removed, such an amount of contraction might be artificially induced, as would, in some degree, counteract the contraction of the plantar tissues, and prevent the os calcis from being drawn from its naturally almost horizontal position into one nearly vertical. I twice performed this operation with so little benefit that I do not recommend its repetition.* (See description of figs. 63, 64.)

* The above observations on the inutility of the removal of portion of the tendo-Achillis constitute the whole that the author has ever said or written on the subject. He was much surprised to read in one of a series of papers on the pathology of deformities, contained in the *Lancet* four or five years ago, by a surgeon of peculiar pretensions, that "Dr. Little recommends that when a muscle is too long, a portion of it should be cut out; and that

I may describe the treatment that I have found advantageous under two heads; that applicable to the earliest stage, before great contraction results, and that necessary when the deformity is considerable. It is unnecessary to repeat here the general means of endeavouring to remove paralysis or prevent contraction. Those specially applicable to Talipes calcaneus consist of a mechanical instrument, or iron, so arranged at the ankle-joint as to prevent bending of the foot beyond a right angle. If the instrument-maker possesses sufficient ingenuity and skill to accomplish this by a spring (p. 35), the object of assisting the weak gastrocnemii and controlling the over-acting anterior muscles of the ankle will be realised. The patient should wear a contrivance at night for a similar purpose (figs. 65 and 66).

[For many years the author has been accustomed to employ this apparatus, contrived by him for prevention of the deformity, when the initiatory paralysis is discovered, and for restoration of such cases, whether or no surgical

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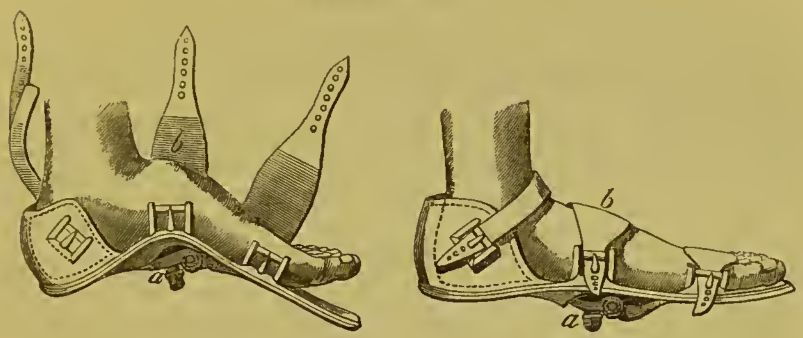
when it is too short, it should be cut through." The author, considering the source of this mis-statement of his opinions, did not believe it consistent with the position he desires to hold in the estimation of his medieal brethren to notiee it. The same attempt to discredit tenotomy in the practise of its known promulgator is repeated, *ipsissimis verbis*, in a treatise "*On the Pathology of Deformities*" reeently published. If a person profess to write on the pathology of deformities, and criticise, or pretend to quote an author's views, it may reasonably be expected that he should have previously made himself aequainted with those views, and have had some experience in the matter in question. The extraordinary errors into which the writer in question has fallen proves that he possesses neither of these qualifieations for a eritie on the writings and praetice of others.

The Leetures here reprinted after the lapse of nearly ten years demonstrate the author's anxiety to reduee the application of tenotomy as a rule to eases in whieh struetural or organie shortening of tissue has taken plaee, and which oppose approved mechanical treatment. Respecting removal of a part of a tendon, the text shews that, although the author considered the operation as one not unworthy of trial, he diseountenaneed its application on the ground that equal benefit could be obtained without it.

operation has been performed as a preliminary proceeding. It is scarcely necessary to observe, that it is intended to be

Figs. 65. and 66.



worn at night only, or during repose, whilst at study for example, or during any sedentary occupation. He has never tried reversing its application to the dorsum of the foot, which would be practicable; nor the addition of thick heel and toe pieces, so as to permit its use during locomotion. Latterly he has used the ratchet movement *a* substituted for male and female screw.]

A raised heel is often serviceable by more completely throwing the weight of the body on the tarsal arch; for unless attention be given to this circumstance, partial displacement of the tibia and fibula backward ensues. If, in the progress of the deformity, the toes incline outwardly, as in valgus, constituting Talipes calcaneo-valgus, the peronei may become structurally shorter, and the foot not replaceable beneath the axis of the leg without mechanical elongation of the peronei, or even section of them. When, however, the deformity is severe, palliation is the utmost that can be effected. In such cases a spring, with convexity towards the inside of the leg, or an "iron" upon the outside, should be worn.

[The author has met with some rare cases of lameness and deformity, which, besides their inherent interest, are valuable in throwing light upon the pathology of calca-

neus.* Thus he has seen this deformity produced by peripheral paralysis of gastrocnemii after over-exertion,† by accidental rupture of tendo-Achillis,‡ and by imperfect reunion after surgical division of it.§]

* The prefix 'Talipes' will often, for the sake of brevity, be dropped in the succeeding pages.

† A gentleman aged 32, by temperament predisposed to disorder of nervous system, much addicted to field-sports, observed, after a long walk over ploughed ground, weakness of the left leg, at first attributed to sprain or over-exertion. The accompanying lameness did not subside. Gradually he perceived an inability to hop or spring with the affected member, and he suffered pains in the ankle similar to those which result from excessive standing. A few months after the occurrence of the lameness he consulted the author. On examination, partial wasting and flabbiness, with imperfect volition in the muscles of the calf, were observed. The heel was already larger than the opposite, and complaint was made of uneasy sensations in it, as if produced by undue pressure; the sole was beginning to contract, and the peronei to manifest an undue influence in the movements of the foot. Diagnosis: Peripheral partial paralysis of gastrocnemii from excessive exertion, relaxation of tendo-Achillis, weight of body inordinately borne by the heel, development of calcaneus, and probably ultimate calcaneo-valgus from preponderating action of anterior and external muscles of the ankle.

‡ A stout gentleman about 40 years of age ruptured the tendo-Achillis in jumping from a considerable height upon the deck of a ship. The resulting injury and lameness were attributed to sprain, and rest for a few days was enjoined. Lameness, however, continued, accompanied with gradual wasting of the calf. A few months afterwards the author was consulted. The patient walked with much lameness, and was soon fatigued; the gait was particularly deficient in elasticity. The foot, on examination, had already acquired distinct traces of calcaneus. The posterior part of the foot (calx) was abnormally large, the tendons on front of ankle unnaturally tense; the anterior part of the sole exhibited, in the comparative softness of the integuments, a want of evidence of use; the calf was short and attenuated, and the tendo-Achillis united by a slender ligamentous band. It is scarcely necessary to observe, that calcaneus in a person aged 40 would never reach the grade attained in children, in whom the deformity progresses during the growing period of the frame. The simple surgical proceedings described in the following case would have entirely restored the patient. The gentleman in question being compelled to return to Australia, could not devote the time requisite for *cure*.

§ A third case of incipient calcaneo-valgus, induced by an uncommon cause, was observed by the author in 1841, in consultation with Mr. Jackson, Spitalfields.

A young girl affected with slight angular knee-contracture and contracture

I cannot quit the subject of Talipes calcaneus without directing attention to a deformity of this nature artificially produced among the Chinese. Here is an anatomical draw-

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of ankle (equinus), after inflammation and suppuration in the leg, underwent section of T. Achillis and peronei. Either through constitutional debility or coldness of the weather, the ordinary effusion of uniting medium did not take place. Six weeks afterwards, notwithstanding the heel had been carefully kept elevated, the foot was flexible and straight; she could walk without pain, but with some lameness. The fears of imperfect reunion of tendo-Achillis which had been entertained were justified by the result; for it was at this period observed that she trod exclusively on the heel, and that the anterior muscles of the ankle elevated the front part of the foot from the ground. Traces of calcaneo-valgus were already observed in the form of the heel and sole. The divided extremities of the tendo-Achillis, still somewhat swollen, were seen and felt nearly two inches asunder; they appeared to be connected by a thin strip of ligamentous or other band, probably only the thickened fascia.

At the eighth week the author devised and executed the following operative proceeding for effecting reunion of tendo-Achillis:

The patient was placed in the prone position. Holding an ordinary narrow sharp-pointed tenotomy knife in a position transverse to the limb, the operator introduced it through the integuments on the outer side of the ordinary course of the tendo-Achillis, near the spot where the section of the tendon had at the outset been effected. After traversing the integuments, he shifted the direction of the tenotome, directing it parallel to the limb, carrying the point of the knife upwards towards the superior end of the tendo-Achillis, and with it lacerating any adhesions the tendon might have contracted in that situation, as well as the face of the severed end, so as to insure exudation of blood and plastic matters from its surface; the point was then swept downwards, along the interval left by the retracted upper end of the tendon towards the cut surface of the lower portion of the tendon: this was similarly lacerated, and the knife withdrawn. A puncture in the integuments remained, through which a few drops of blood issued. The previous gap between the ends of the tendons was now occupied by a considerable sanguineous effusion.

The steps of this operation, thus fully detailed, occupied but a few seconds, and caused but trifling pain, compared with the important probable result of reunion of the tendo-Achillis. The knee, leg, and foot were again carefully, but not tightly, bandaged in the extended position, so as to approximate as nearly as possible the severed ends of the tendon, and to keep the knee and ankle joints in repose. Neither inflammation nor pain followed. At the expiration of a fortnight the splint and bandage were removed. Abundant effusion of plastic material and adhesion of tendon had taken place. Very cautious bending of the ankle was now effected. In ten days it was reported that the foot was flexed to an angle of 45°. At the expiration of a month permission was given to recommence gentle exercise, using a laced boot supported by an iron stem. At the end of the sixth week the report states: "Union of tendo-Achillis perfect, the foot is perfectly flexed, the knee straight and flexible, she walks in a common boot."

The author occasionally saw this patient afterwards. No trace of Talipes equinus, or of Talipes calcaneo-valgus, remained; indeed, restoration was complete.

Jan. 18, 1845. The tendo-Achillis somewhat longer than natural; slightly thickened at the operated part; no adhesions to integuments; right surales short; difference between bulk of the muscles of the calf on both sides inconsiderable; walks perfectly free from lameness.

Remarks from Provincial Medical and Surgical Journal, May 1851.—"The author is

ing of the bones of the foot of a Chinese lady, obtained during the late China expedition (fig. 67). I possess no anatomical drawing of the dissection of a Talipes calcaneus produced naturally in the manner previously described, as I have had no opportunity of dissecting this deformity after death; but you can compare the drawing of the dissected Chinese lady's

Fig. 67.

Artificial skeleton of a Chinese Lady's foot. "*Artificial T. calcaneus.*" I am indebted for this drawing to Mr. Goldsmith, Islington.

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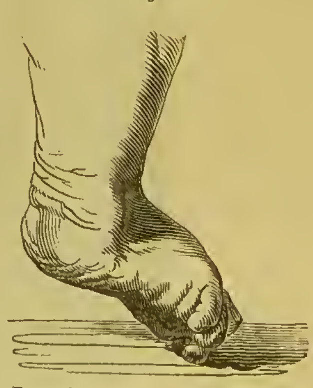
induced to give publicity to this case less as an instance of successful cure with the aid of tenotomy, than to point out the manner in which an accidental failure of union of a severed or ruptured tendo-Achillis might be repaired. The instance related shews that non-union of a severed or ruptured tendo-Achillis, although a rare occurrence, is not a mere hypothetical case.

"The causes of non-union in the child appeared to be diminished effusion of plastic matter immediately after section of the tendo-Achillis, the consequence of languor of circulation, or of some inherent vice of constitution, aggravated by the too-sudden elongation of the space between the severed ends of the tendon, either by the mechanical instrument used, or by the injudiciously early walking exercise. The slowness with which wounds cicatrise in a cold climate is well-known, and the author has witnessed a puncture resulting from subcutaneous tenotomy bleed like a fresh puncture ten days after operation during the rigours of a severe Berlin winter; and frequently in cold weather in our own country he has found it necessary, after subcutaneous tenotomy, to envelope a feeble limb with cotton and flannel in order to accelerate union. The influence of too-considerable and too-early separation of the ends of a severed tendon, and especially of frequent motion, as in walking, in interfering with union, is incontestable. The reparative powers of the system, however, usually suffice to neutralise any injury from too-great or too-hasty separation. Experiments upon animals have proved that considerable lengths of tendon may be excised, and union nevertheless ensue; but the knowledge possessed of the great extent of the powers of the economy and of a part, is an insufficient reason for neglect of those rules and acts of caution which experience dictates. The immediate separation of a severed tendon to too great an extent should be avoided. Half or three quarters of an inch may be safely borne, although as a rule gradual separation is preferable. The condition of a severed tendon approaches that of a fractured bone; too-great separation of the severed ends, depression of temperature sufficient to suspend active arterial circulation, too-early movement of the parts, and inherent vice of constitution, will cause tendon and bone to remain ununited, to the great detriment of the sufferer." Stromeyer relates from *Edin. Med. and Surg. Journal*, Oct. 1836, that Mr. Syme reunited a divided tendo-Achillis by cutting down upon it and bringing the ends together by suture. Risk of suppuration great in this proceeding!

foot with the model of the highest grade of Talipes calcaneus, and you will perceive the similarity, if not the exact identity, in the conformation of the bony structures in the two cases, except as regards the smaller toes. The artificial deformity is effected by tightly bandaging the foot in early life, and folding the smaller toes beneath the sole. This evidently renders locomotion on the sole painful; the individual is constrained to walk exclusively on the heel; the anterior muscles of the leg acquire a preponderance, and elevate the dorsum of the foot; the muscles and ligaments of the sole increase the convexity of the dorsum and consequent concavity of the planta; and the gastrocnemii probably become in time atrophied and powerless, rendering the analogy with the natural Talipes calcaneus complete. The artificial will offer a far greater chance of cure than the natural deformity, as in the artificial absolute paralysis of gastrocnemii does not exist. I do not entertain the slightest doubt that it may be entirely cured, even after thirty or forty years' duration, by means similar to those employed in its production, viz. appropriate bandaging; and should any muscles have become structurally shorter and insuperably oppose elongation, tenotomy might be employed. The assiduous labour of years wilfully occupied in distorting nature might be undone in a few weeks.

Fig. 68.

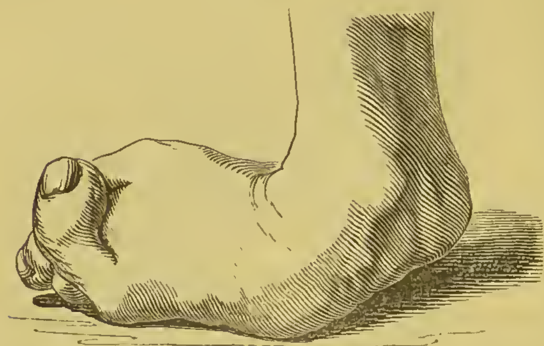


T. equino-valgus. Contraction of gastrocnemii and peronei from paralysis of anterior tibial.

[The form of paralytic or spastic Talipes equino-valgus (elevation of heel with eversion of toes) is well illustrated by the fig. 68. The example is taken from a child before secondary deformity from standing or walking has been produced. The objects to be attained in the treatment consist, 1st, of remedies directed to removal of the spasm or of the paralysis; 2d, of those calculated to prevent struc-

tural shortening of the contracted muscles; and 3d, mechanical support to prevent secondary deformity from use of the member.]

Fig. 69.



Talipes valgus paralyticus.

Here is a model (fig. 69) which will illustrate the nature of paralytic Talipes valgus, and here another (fig. 70) illustrative of paralytic varus.

[Reflection on the extreme deformity presented in fig. 69 has led me to the conclusion that it was originally more similar in form to the case of T. equino-valgus, fig. 68, and that it has attained

Fig. 70.

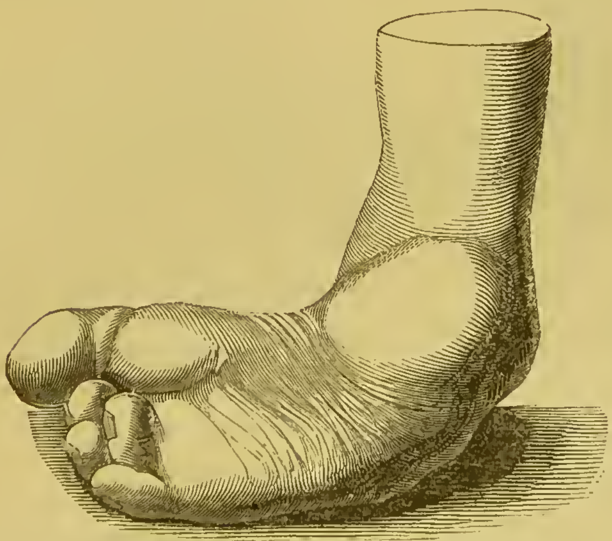
Talipes varus paralyticus (anterior aspect).

the present state through aggravation by use of the limb. It will be obvious that if the subject of fig. 68 were left to nature, the act of treading on the inner margin of the great toe would tend more and more to evert the foot, and the entire inner margin in time touch the ground; but as

in T. equino-valgus the gastrocnemii are tense and contracted, the tendo-Achillis would resist depression of the heel, consequently the foot would bend in its middle, the heel being slightly elevated, contrary to the disposition of the same part in T. calcaneo-valgus. The fig. 69 therefore, although designated T. valgus, is in reality T. equino-valgus, in which secondary deformity has taken place.]

I have sufficiently described the general treatment of these deformities; a few special considerations only need detain us. In both, after restoration of form, a properly constructed shoe, to hold the foot in a straight position, and to facilitate locomotion, may be required; when much structural shortening exists in valgus, section of the peronei may be indispensable; and in (paralytic) varus, division of the posterior tibial, tendo-Achillis, and plantar tissues, may be required. (See Operations, p. 92.)

Fig. 71.



T. varus paralyticus (*posterior aspect*). Treatment: Section of T. Achillis and mechanical extension of remaining contracted structures. The reader desirous of possessing the minute details of history and treatment will find them, Case XXII., appended to first edition of *Treatise on Club-foot, &c.*

[The instruments best adapted for the mechanical treat-

ment of several contractures will be found under the treatment of "Congenital distortions."]

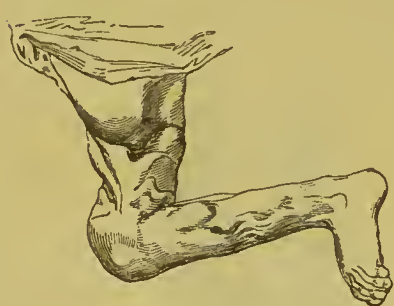
The following diagram of contractures of the ankle is intended to shew the manner in which the compound forms are derived from simple ones.

Simple Forms.	*Compound Forms.*
1. Talipes equinus.	5. Talipes equino-valgus.
2. Talipes valgus.	6. Talipes equino-varus.
3. Talipes varus.	7. Talipes calcaneo-valgus.
4. Talipes calcaneus.	[8. (?) Talipes calcaneo-varus.]

Each may be either spastic or paralytic.*

[The following distortion will illustrate contracture arising from combined causes: — habitual retention of members in one position, with contraction of cicatrices. Fig. 72 represents the knee and foot of a child who suffered from extensive phlegmonous erysipelas at the early age of five months. Profuse deep-seated suppuration extending from hip to foot, pointing in numerous situations, ensued, the limb having been literally riddled with openings. The deep seams, bridles, and inequalities, formed by dense fibro-cutaneous cicatrices, yet visible, suggest the extent to which the various muscular, fascial, and tegumentary structures became permanently agglutinated. The knee, although capable of further flexion, was incapable of extension beyond the position shewn in

Fig. 72.



Knee and ankle contracture from habitual retention in one position (pp. 13, 52), *and contraction of cicatrices after phlegmonous erysipelas.*

* The author has added to these forms the query whether a T. calcaneo-varus from spasm or paralysis exists. He has seen no such contracture, although a congenital distortion which might be so named does exist.

the figure; the ankle, although not immovable, permitted no *range* either of flexion or extension. The leg was outwardly rotated, partaking much of the character of genu-valgum (see Rachitic Deformities), the patella presenting upon the external condyle. On endeavouring to extend the knee and foot, the tension of the immense cicatrix on the outside of the knee and thigh, with the subjacent biceps tendon, and of a cicatrix on front of ankle, which involved the anterior muscles of ankle, was much augmented. The fig. 73 indicates the extent to which restoration, with the aid of section of biceps femoris and patient mechanical extension, was effected.*

Fig. 73.

Knee as restored after contracture from abscesses.

* The child, when placed under treatment, had attained the age of five, never having walked. Tenotomy was performed, May 1851, with the efficient assistance of Dr. Freeman of Edgebaston (a gentleman whose early retirement from the practice of his profession is a loss to science). In order to prevent disturbance of the limb, interference with healing of the puncture, and possible setting-up of a poiut of suppuration in the ham, the limb was carefully maintained at rest, for a few days, upon a common bent knee-splint. It may here be observed, that this precaution was taken rather in deference to a somewhat antiquated pathology, which regards cicatrix as more susceptible of injury, than from the belief of its absolute necessity; for the author's experience shews, that after a cicatrix or *new* tissue has become somewhat old, it more fully partakes of the vitality of surrounding parts, and may be freely dealt with by the surgeon. On the sixth day a common knee-extending apparatus, consisting of two metal splints connected by a hinge opposite the ham, regulated by a ratchet-screw (p. 80), with an ordinary foot-piece as in Club-foot (see Congenital Distortions), was applied. The mass of resisting structures rendered slow progress unavoidable; at the expiration of six weeks the knee was extended, but inversion of knee (*Genu valgum*) more considerable. The apparatus was now modified by placing the adjusting screw on outside of limb, instead of opposite the ham; by which means, in the course of an additional six weeks, the inversion of knee was overcome, and the knee in the

Another remarkable contracture from preponderance of one set of muscles and habitual retention in one position, is afforded by the subject of fig. 74,* which represents the case of a young lady, æt. 15, who seven years before laboured under severe typhus fever, during which extensive sloughs posteriorly, involving nearly the whole of the sacrum and nates, and laterally exposing both trochanters, occurred.

Fig. 74.

Probably through weakening of glutæi muscles, the adductors of the thighs habitually drew the limbs inwardly ; and ultimately their contraction being unresisted by volition, crossed

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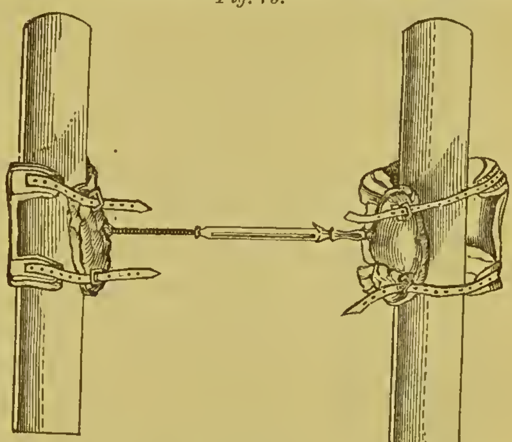
position seen fig. 73. The foot in the meanwhile favourably progressed without operation. The child now made his first attempts at walking, flexion of knee to the extent of a few degrees was acquired, and in five months from the date of tenotomy walked very well. He was dismissed from treatment with the injunction to the friends not to sacrifice the straight position of the limb during attempts to acquire more mobility of the joint. In all cases of knee-deformity, in which the patella has permanently quitted the trochlea of the condyles, it is undesirable to attempt the acquisition of much mobility; for the want of a proper fulcrum on which the extensor muscles can act, renders mobility of knee-joint a source of weakness rather than of strength. In many cases considerable improvement in position of patella is obtained during the mechanical strengthening of the knee. This replacement is prevented when the patella is drawn from its place, as in the present case, by dense fibro-cutaneous cicatrices. The cicatrix which thus abnormally holds the patella is shewn in fig. 73. I have since heard from Dr. Freeman that the case has done well.

* The right foot presented in the situation of the left, and *vice versâ.* Excepting the awkward appearance of the feet thus reversed, no deformity was apparent in the sitting posture. The diagnosis and prognosis were obscure, in consequence of the immobility of thighs having prevented examination of condition of hip-joints ; but, notwithstanding the apparent improbability of restoration of position, replacement was attempted solely by mechanical means.

the limbs over each other, in which uncommon position they were rigidly fixed at the period of the author's first examination. The case* is, moreover, extraordinary, by indicating the enormous loss of parts by sloughing after typhus, from which a *young* person may recover by judicious and persevering attention on the part of the surgeon.†

Manipulations (p. 26), calculated to separate the thighs ; then the interposition of pads between the limbs, and afterwards a male and female screw, adjusted so as to press against the internal condyles, constituted the means used (see fig. 75). After four months' continuance of this treatment the limbs could voluntarily be held asunder, aud gradually locomotion was attempted. At the expiration of other two months, locomotion with crutches was exchanged for the use of sticks ; and although from the hollowness of lumbar region and limited movement of hip-joints, it became evident that the suspicions respecting the hip-joints (extra-articular implication) were justified, the beneficial change in the patient's condition was matter of surprise to all her friends. She had not walked since the original illness.

Fig. 75.



This simple apparatus, devised by the author, has been published without acknowledgment by a surgeon who is indebted to the author for a knowledge of its use.

* The author has to thank Mr. Adams of Lymington, Hants, for the history of this interesting case.

† Whilst alluding to the subject of sloughs during or after continued fever, the author may be permitted to mention a severe case which came under his notice in consultation with Mr. Arthur of Shadwell, and which exemplifies the value of the prone position in some states of disease :

A boy, æt. eleven, at sixth week of continued fever, presented an enormous slough, upwards of nine inches in diameter, exposing bones and muscles of sacrum and nates. The knees were pertinaciously flexed, and approached to the abdomen. Any movement of limbs or trunk called forth agonising cries. Abandonment of the copiously suppurating surface enveloped in soothing cataplasms, exposed to some pressure in the supine position, even upon a water-bed, appeared unavoidable; whilst recovery from so great destruction of parts in the enfeebled typhus convalescent seemed improbable. It was regarded as a lost case. Trial of a prone position was for the following reasons indicated: 1st. Extension of the thighs rather than flexion would be favoured by it, and thus a

Many cases popularly termed locked-jaw, sometimes accompanied with cicatrices in the mouth, consequent upon the ulceration which occurs after fevers, ptyalism, stomatitis, or cancrum oris, present themselves, in which, after patient trial of mechanical means, and a satisfactory diagnosis of absence of true ankylosis of the maxillary articulations, myotomy and division of cicatrised bands, if any such be present, would lead to relief of the contracture. The author has successfully employed division of masseters in a case the particulars of which have been already published (see the *Lancet*, Sept. 6, 1851; see also Appendix). If the teeth can be separated to the extent of a line or more, boxwood wedges, or a piece of bone or ivory, wedge-shaped at the extremity, and provided with a handle long enough to be used as a lever, or the instrument, fig. 76, may be employed for mechanical separation of the maxillæ. These means have the disadvantage of exercising pressure upon two opposing teeth only. If the mouth can be more widely opened, the apparatus, fig. 77, will better adapt itself to the incisor teeth. Cases, however, occur, in which, in conse-

Fig. 76.

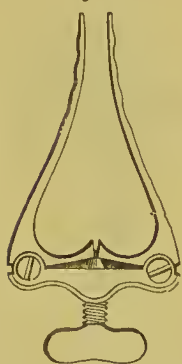
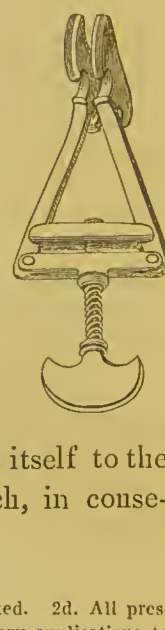
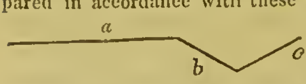


Fig. 77.



lessening of the size of the suppurating surface be immediately effected. 2d. All pressure upon the wounds, and movement of the sufferer during necessary applications to them, would be avoided. 3. This position, whilst remedying the approximation of the thighs to the abdomen, would favour straightening of the knees, as these parts could scarcely continue long flexed in the prone position of the trunk. A rude couch was prepared in accordance with these indications, consisting of an ordinary double inclined plane reversed, of which the annexed diagram represents the section: *a*, section of surface upon which the head, chest, and abdomen reposed; *b*, section of piece connected by hinges to *a*, adapted to thighs; *c*, section of piece similarly fixed by hinges to *b*, adjusted to legs. The patient at once obtained relief and sound sleep upon this couch; he partook heartily of animal food and good malt liquor. The pieces *c* and *b* were gradually brought into a line with *a*, and in a few weeks the sores were entirely healed, and the patient restored to health and activity.



quence of the mouth being so firmly closed that the edges of the lower incisors are on a higher plane than those of the upper teeth (within and behind the upper teeth), none of these contrivances can be introduced. Under these adverse circumstances, an ingenious combination of the wedge and screw (fig. 78), devised by my friend and colleague, Mr. Barrett of Finsbury Square, is invaluable. The centre part may be constructed thin enough to pass through the smallest separation of the teeth, and may be bent so as to be looped over the concealed lower incisors. It possesses the additional advantage, that when thus introduced into the mouth, after passing between the upper and lower incisors, it can readily be pushed between the molars, and the force be applied upon that part of the dental arch (the molar) which bears pressure with the least inconvenience or suffering. The apparatus may, moreover, be made to act upon one ramus or upon both rami of the maxilla at the same time. The author has derived great advantage from anæsthesia to the first degree in a difficult case, by its having facilitated introduction of the instrument. In consultation with Mr. Barrett, and another friend and colleague at the London Hospital, Dr. Parker, full separation of maxillæ which had been immovably closed fourteen years, in consequence of suppuration in both parotid regions after scarlatina in childhood, was accomplished.]

*Fig. 78.**

* *Mr. Barrett's instrument for opening mouth closed from muscular or other contraction.* *a*, metallic oblong frame constructed of German silver (a metallic compound believed by Mr. Barrett not to excite, when introduced into the mouth, the involuntary contractility observed during the use of a similar instrument of steel); *b b*, ivory wedges, destined to be propelled onwards by the action of the screws *c c*; *d d*, metallic pins or rivets firmly connecting the lower piece of metal frame to the end pieces. The upper piece of metal frame is only loosely secured by these pins, in order that thicker wedges, when required during the progress of the case, may be introduced into the frame. The edges of upper and lower pieces of the frame may be turned towards the opposite piece, by which means a channel is formed, along which the wedges can be propelled without their thin ends quitting the frame.

LECTURE XI.

Contracted hand and fingers from disease of palmar fascia — Probability of origin from gastro-intestinal disturbance and rheumatic diathesis — [Neck deformity from syphilis] — Spasmodic contracture of fingers and hand — [Writer's cramp and paralysis] — Treatment — Non-congenital wry-neck from spastic contraction, paralysis, rheumatism, voluntary retention [from diseased lymphatic glands] — Treatment — Utility of section of sterno-cleido-mastoideus — [Contractures from cicatrices of burns — Mechanical extension — Section of contracted bands.]

When one or more of the articulations of a finger become contracted from disease of the articulations, often complicated with thecal abscess, the case constitutes false ankylosis of the affected articulation, the treatment of which has been already described. I may here remark, that such deformities of the finger do not admit of restoration; or if the bent condition be removed by tenotomy, the function is not always restored, either in consequence of the tendons having sloughed, or from their having become adherent to the sheath during the primary disease, or from the articular surfaces having received irreparable injury. But in *contracture* of the fingers the abnormal flexion has resulted from causes which have operated indirectly on the articulations. These causes may be superficial inflammation of the hand and fingers, chronic disease or injury of the palmar fascia, superficial wounds of the finger, injury to the flexor tendons, rheumatic inflammation (p. 100), and lastly, disease in the nervous system, in which case the contracted finger ranks as a spasmodic or paralytic contracture.

One of the most interesting and common forms of contracted finger is that resulting from disease of the palmar fascia, as at p. 105. In this affection the middle, ring, and little fingers are principally liable to contracture. I do not

remember to have witnessed contracture of the forefinger from this cause.* This probably depends on the anatomical distribution of the fascia. The contracture [usually] commences without obvious cause, the patient's attention being attracted to a stiffness in the palm, and an incapability of completely straightening one or more of the fingers. The contraction and stiffness increase, until the tip of the ring or middle finger is drawn completely into the palm, greatly interfering with the functions of the hand. The contracted condition of the finger is constant, not varying in extent at different periods, as some contractures from other causes. Its progress is slow, several years elapsing before the deformity attains the highest grade.

An examination of the finger shews that the deformity is maintained by an indurated, inelastic, hypertrophied condition of the palmar fascia. The individual retains the power of flexing and extending the finger, within the range permitted by the contracted fascia. A tense cord is perceived extending along the palm, towards the most contracted finger, in part arising from shortening of one of the flexor tendons thrown into relief by its contraction. The habitual state of the hand in the individual from whom this model (fig. 79) was taken, was one of greater contraction; the model represents the appearance when the patient endeavoured, by muscular action, to extend

Fig. 79.

Contracture of fingers from disease of palmar fascia.†

* Since the above was written the author has witnessed conjoint affection of all the fingers, the thumb and forefinger having been less affected than the remainder.

† This complaint is often hereditary. It is difficult to determine what complaint is not hereditary.

the fingers. The pathology of this affection is interesting. From the [usual] inability of patients to assign any cause for the contraction, I have been induced to search for it in some abnormal condition of the general system. I have witnessed instances of the contracture in persons of different trades and professions,—coachmen, bakers, artisans, clerks, and individuals of the richer classes following no manual occupation. It usually affects both hands, though in different degrees, and sometimes the soles of the feet present a similar affection of the plantar fascia. Every patient had suffered from some form of dyspepsia, from rheumatism, and lithic acid urinary deposits; and the majority admitted that at some period of their lives they had partaken freely of wine or other fermented liquors. Hence a rational pathology leads to the conclusion, that this induration and thickening of the fascia is one of the forms in which a rheumatic or arthritic diathesis manifests itself. It is apparent that the affection of the fascia is primary, and that the contraction of the flexor tendons is secondary, consisting of structural shortening from long continuance of the deformity, independent of any lesion or innervation of the muscles of the fore-arm.

[One gentleman attributed the complaint in both hands to his having, as a workman in some branch of the useful arts, been employed for many hours daily, during several years in early life, polishing metallic surfaces by means of emery with the palms of the hands.

The constitutional cause may sometimes be only the predisposing cause, a local injury the exciting cause of this affection.]

Treatment.—Subcutaneous section of one or more of the bands of contracted fascia, extending towards the fingers, and of the subjacent flexor tendons. These operations should be done in the part of the palm where the tension is most evident, and with the view of preventing adhesion of the tendon to other divided structures, as in a cicatrix.

I have preferred severing the tendon apart from the fascia. I have witnessed no case in which the puncture has not healed by adhesion within forty-eight hours. After adhesion the contracted fingers should be gradually straightened by being bandaged on a splint. It is not desirable to effect this part of the treatment too rapidly, as great pain will be produced by the attempt. Three weeks or a month usually suffice for removal of the resistance presented by the various textures of the palm that have been long contracted,—for it should be remarked that the abnormal condition of the fascia renders the palm unnaturally concave. The use of the fingers is entirely restored, and at the expiration of a few months the induration and thickening of fascia being slowly removed by absorption, no trace of the deformity will remain, as in this model (fig. 80), which represents fig. 79 after the cure. In this case section of the band of fascia and of the tendon proceeding to the middle finger, was the only operation requisite; the consequent relaxation of the fascia and loosening of the palm permitted the complete straightening of the remaining fingers.

Fig. 80.

Cure of contracture of fingers from disease of palmar fascia.

[Slight cases of this nature yield to moderate continuance of mechanical treatment alone; and even in severe cases, when from age of the patient, or other circumstances, it is undesirable to do even the slightest operation, great amelioration is obtainable from manipulations and gentle mechanical treatment.

These cases are apt to relapse if manipulation or the diet be neglected. The subject of fig. 80 has three times in eleven years requested me to repeat the operation. The

relief is so complete, and its permanency so much under the control of the patient, that this tolerance of the trivial operation is not surprising. In consultations it has been objected *in toto* to the operation, that the contracture is apt to return; to which it may be replied, that the contracture in question differs not in this respect from thoracic, abdominal, or indeed from the majority of internal local diseases, which tend to return on fresh application of the remote and exciting causes, or neglect of the means enjoined to prevent relapse.]

Similar contracture of a finger from a wound of the palm, or of the finger itself, although the wound may have united by adhesion immediately after the injury, is not unfrequent. The treatment should be conducted on the principles already laid down.

[A rare case of neck-deformity from disease of cervical fascia (figs. 81 and 82) is here introduced, from its analogy

Fig. 81.

Fig. 82.

to contracture of hand and fingers induced by disease of palmar fascia. The neck was almost immovable, and the chin firmly bound and inclined towards the sternum by the indurated and hypertrophied fascia. The constitutional powers of the patient had been reduced by the combined influence of "rheumatic fever," syphilis, primary

and secondary, and mercurial ptyalism. The contracture had existed about six years.*]

The spasmodic contractures of the fingers are more complicated in their pathology, and more difficult and uncertain in their treatment. This state is often associated with spastic affection of the wrist and arm, as in this model (fig. 31, p. 109), with spastic affection of the toes, or of the face or neck. You will experience no difficulty in distinguishing it from paralytic contracture, which it so greatly resembles in appearance, by remarking that the patient possesses power of volition in the extensor muscles, but that these muscles are overpowered by the spasmodic condition of the flexors. The contraction of the flexors is often more convulsive or clonic than spastic.

Here are models illustrative of the different grades. In the majority the thumb is firmly drawn into the palm. I cannot speak favourably of tenotomy when practised where the tendons are enclosed in the thecæ, but when effected in the palm it has proved more successful. In some instances, where the affection was combined with abnormal flexion of the wrist, I have divided the flexor sublimis digitorum, the flexor longus pollicis, flexor radia-

* The patient, a female, aged 40, who had borne a large family, many of the later children having been still-born, was admitted into the London Hospital on several occasions during the years 1846, 7, 8, on account of neck-contracture, syphilitic nodes on sternum and ulnæ, painful tibiæ without nodes, ulcerated sore throat, and general debility. She derived benefit from potasii iodidum, quinine, and generous diet. She was admitted on the last occasion for severe erysipelas of head, face, and neck, and double pneumonia. During the progress of the erysipelas an abscess formed in the neck, and discharged at pomum adami. She sank on fourteenth day of the acute disease. Autopsy; consolidation of inferior half of both lungs, with incipient purulent infiltration. The neck-contracture was found to depend upon cartilaginiform induration, with hypertrophy of superficial and deep fasciæ of front of neck. The platysma, the sterno-hyoid, thyroid, and mastoid muscles, were structurally shortened, and presented unusual firmness, and appeared to have partially undergone fibrous transformation. The patient had also been affected with induration of fascia on calf of leg, which had yielded to the topical application of iodine.

lis and ulnaris, above the wrist, with much advantage. The operation has been less directly beneficial in restoring the use of the member than as serving as a starting-point for improvement. Thus, the patient after the operation is sensible of the removal of a powerful obstacle to the action of the extensors, and is enabled to use them more effectually in controlling the remaining active flexors (for in these cases the flexors generally are involved). Persevering education of the muscles becomes necessary for the obtainment of a useful member. In some instances I have succeeded so far in restoration that the individual has been enabled to use the hand in coarse manipulations, and in one case to write tolerably well.

[Spastic contraction of muscles of the hand induced by excessive use of particular muscles, as in excessive writing (*Schreibekrampf* of the Germans), or from excessive use of the fingers in instrumental music, as at the pianoforte, are occasionally met with in adults (unaffected with chorea). A very slight affection of this nature, amounting only to an occasional jerk of the pen, is not uncommon in persons of enfeebled nervous system who write in a hurried manner.* A similar affection is more common in the facial muscles. Stromeyer has found division of the flexor and opponens pollicis muscles beneficial. Dieffenbach has severed the orbicularis, zygomatici, and levator anguli oris in a severe case.† Tonics, attention to general health, and removal of predisposing and exciting causes, constitute the preferable treatment. Sometimes the affected writer can direct the pen if it be passed through a thick piece of cork, which is

* "The nerves that in artists or mechanics have been developed by special practice of a part are liable to become the seat of spasmodic action."—Romberg, *Manual of Nervous Dis.*, Sydenham Soc. transl., vol. i. p. 284.

† Stromeyer, Beiträge zur operativen Orthopädik, 1838. Dieffenbach über die Durchschneidung der Muskeln und Sehnen, 1841.

Froriep "on Electro-Magnetism," translated by Dr. Lawrence, 1850, reports cures by the use of this agent. The excellent Berlin surgeon does not mention what dietetic, social, or hygienic treatment he may have simultaneously employed. See observations on electricity, p. 45 of this volume.

more easily grasped than a smaller substance. An operation is justifiable, as in the analogous case of spasmodic (clonic) jerking wry-neck (pp. 120, 192), when the patient's livelihood is endangered or his state of mind and body is impaired by the protracted existence of the complaint.* Paralysis of one or more muscles of the hand from excessive use, as in writing for example,† or at the piano,‡ is more frequent than protracted clonic spasm.§

Great improvement may be effected in the spasmodically affected hands of children partially idiotic or imbecile, simultaneously with the improvement effected in the mental and remaining corporeal condition of the in-

* The occurrence of this abnormal muscular action (spasmodic) of muscles which have been inordinately physiologically used, seems pathologically allied to the state which occurs, it is stated, to some omnibus-conductors, who are unable to sit still at meals after habitual jolting upon their standing-board.

† "Mr. A. B., aged 35, since boyhood engaged writing greater part of the day, and often at the Clearing House in the City until after midnight, the nature of his duties requiring him to write very quickly, has lost the power of holding and guiding the pen without any spasm. Other muscles of the hand and wrist are unaffected. He appeared of nervous temperament, induced by late hours, exciting hurried nature of occupation, and habitual inattention to regular hours for taking food. He was recommended a tonic regimen, to abstain from writing, and three months' sojourn at sea-side. After a few weeks' adoption of this prescription he had improved, but the ultimate result has not yet been ascertained."

‡ "A lady, aged 26, teacher of the pianoforte in a fashionable watering-place, free from hysteria, not robust, but complaining of no derangement of health except occasional suffering at catamenial periods, has entirely lost the power of the right little finger. Debility was first perceived five months ago. The fleshy mass of the internal palmar region, consisting of the abductor, flexor brevis, and adductor minimi digiti, is obviously wasted. The *remote* cause of the ailment appears to be exhaustion of nervous system, induced by anxious attention to duties, much hurried bodily fatigue incurred in hastening on foot from one appointment to another during the mid-day hours, the habit of passing nine or ten hours without food after only a slender breakfast; whilst the *exciting* cause is the lengthened hours of 'practice' at the piano after her duties of teaching are ended. Tonics, more generous animal diet, food taken at shorter intervals, temporary discontinuance of 'practice,' and the resolution less readily to embrace every fresh engagement offered to her, effected restoration in the course of six months."—*Extracts from Author's Case-book.*

§ The analogy of these cases of peripheral paralysis with that narrated at p. 166 is complete.

dividual. Sometimes children, who have the condition already described under asphyxia neonatorum, exhibit convulsive (clonic) movements of the wrist and fingers whenever they attempt to use the part. Contact of the hand with the pen, or the direction of volition towards the member, calls the aberration of motility into action. This will remind the reader of the aggravation of Talipes when the individual attempts to walk (p. 146), and of the cases in which deformity is present only when use is made of the part—the limb when at rest presenting no abnormal appearance. This intermitting spastic action of muscles (called forth on contact of sole with ground, or by the direction of volition to the part,) reaches its maximum in some instances of universal spastic rigidity of young children, and occasionally after hemiplegia in adults.* Thus the author has under treatment a lady, aged 56, who had hemiplegia a year ago; the paralysis has disappeared, but most painful tonic spastic contraction of gastrocnemii, anterior and posterior tibials, flexors of toes, and apparently extensors of toes, occurs the moment she attempts to stand, and continues so long as she perseveres in the attempt, rendering locomotion impossible. Sometimes the knee is suddenly bent from the same cause, exposing her to sudden falls. Allied to this case of spasm is a case observed by the author in a gentleman, aged 42, of active literary and professional habits, in whom perhaps also a predisposition to nervous disease was acquired in infancy. He suffers in a slight degree from writer's cramp; but when engaged in disproportionably severe use of the hand, as in sawing wood (grasping the hand-saw with the right hand), or using a hammer, the fingers are sometimes involuntarily clenched, preventing him from disengaging the hand from the tool. He relates that on two occasions after driving a pair of horses a long journey, the mind having been somewhat tried by restiveness of the animals in descending a

* See case of this description, Stromeyer, *opus cit.* p. 94. Symbolæ ad Talipedem Varum cognoscendum, W. J. Little, Berolini, 1837, p. 74.

steep hill, the whip-hand bccame suddenly spastically and painfully closed, some seconds having elapsed before the use of it was recovered. The influence of emotion in withdrawing nervous influence from volition (whilst most powerfully *will*ing) was quite perceptible.

As the author is not engaged in writing a treatise on diseases of the nervous system, he refrains from pursuing the subject, notwithstanding its intimate association with the pathology of deformities, but refers the reader to Romberg *opus cit.*

In the clonic hand-spasm of children affected with more or less general spastic rigidity, the author has derived much benefit, without tenotomy, from manipulations, the application of an instrument to the fore-arm, the wrist, and palm, furnished with a hinge opposite the joint, and a gun-lock spring to aid the weak extensors in maintaining extension. He has also for the same purpose adapted thin springs along the dorsal surface of the fingers. He has enabled such individuals to write legibly with the pencil. In some cases education of the hand and fingers has been continued many years, before the individual could carry a fork or glass in safety to the mouth. He has observed the same slow acquisition of voluntary power in cases in which the intellect was but little below average ability.*]

* Amongst the most gratifying effects of medical practice, the author may advert to the mental and bodily improvement in cases of spastic rigidity combined with apparent almost total absence of intellect. Twelve years ago he commenced the treatment of a young gentleman, partially imbecile and much deformed, in whom the attitude of head and trunk, the crouched sitting posture in the corner of a sofa, the retracted lower extremities (the awkward gait upon the toes when locomotion was with assistance attempted), the hands useless, the low development of forehead and smallness of head, the retentive memory of acts of kindness or the contrary, the inability to utter other than animal inarticulate sounds, the painful "roar" when anger or grief overcame him—all reminded the observer more of the Simia tribe than of a human being.

Yet such has been the progress during twelve years, that speech has been acquired, although still indistinct when mentally excited; he can hold the head erect, keep the mouth closed, and prevent escape of saliva; locomotion and

Another deformity, constituting a *contracture*, is the non-congenital wry-neck, or caput obstipum.

This affection is characterised by an inclination of the head to one side, and a peculiar rotation, as in this drawing (p. 107), through which the ear is approximated to the upper part of the sternum. In some cases the deformity is so considerable that the head almost rests on the shoulder.

You will, from my classifying this affection with contractures, at once conjecture that it may be produced by a variety of causes.

Any circumstance, in short, that tends to disturb the equilibrium of the muscles which are attached to the thorax and to the head may induce the deformity at any period of life—spasmodic contraction, paralysis, rheumatism, voluntary inclination of the head to one side during painful affections of lymphatic glands, during vesication from cantharides and other irritating applications, or the cicatrix of a burn. Many of these causes act generally on the muscles of one side, and the deformity may, in the first instance, consist only of a simple leaning of the head to that side; but in consequence of the bulk and power of the sterno-cleido-mastoideus, and the freedom of its course, being unattached except at its extremities, this muscle promptly usurps a predominant influence, even when not specially affected, and converts a simple yielding of the head into a complicated deformity. The diagram before

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horse-exercise without assistance have been achieved, although caution is needed to prevent accidents; he can write legibly with pencil, can use knife and fork, hold a tumbler with both hands, notwithstanding he is still liable to choreal movements if excited or bodily indisposed; his temper is controlled to the extent that he is an amiable member of society; the physiognomy has become comparatively intellectual, and the anterior region of cranium positively enlarged. Although this gentleman, now an adult, will ever remain inferior to the majority of men in his mental and corporeal endowments, the progress made possesses intense interest for the physiological pathologist.

you exhibits a slight case; when more severe the opposite shoulder is greatly depressed, and a curvature of the cervical vertebræ induced. An attentive examination will enable you to discover the structures which principally impede the restoration of the position of the head. The most prominent, and in many cases the sole resistance is afforded by the sterno-cleido-mastoideus. Sometimes the tension of the trapezius evidently modifies the deformity, and often the more deeply situated muscles appear involved, although the belief in this universal muscular affection is derived rather from observation of the effects of treatment than from examinations previously to it. In the majority of instances the sternal portion of the sterno-cleido-mastoideus alone appears tense; sometimes the clavicular portion is especially contracted, in which case the clavicle becomes deformed, and the central part is drawn upwards (p. 119).

The patient is unable to rectify the position of the head, and seldom will you succeed in accomplishing it by forcible manipulation.

The spastic form of non-congenital wry-neck is the most common, and occurs suddenly or gradually, from disease within the nervous centres, manifested, for the greater part, through the instrumentality of the spinal accessory nerve, of which the filaments are distributed to the sterno-mastoideus and trapezius muscles. Sometimes the spasmodic contraction is transient [clonic], or much augmented under emotion; at other times the tension of the muscle is constant, and structural shortening usually exists to a greater or less extent. The paralytic form is not unfrequent; in these cases the deformity is maintained by contraction of those muscles which are deprived of antagonists. Wry-neck consequent upon instinctive retention of the head on one side occurs, almost exclusively, in young persons. In these the deformity is rapidly produced, apparently in consequence of the continued growth of the vertebral

column and of the structures on the side of the neck towards which the head does not incline; whilst the growth of parts on the inclined side being retarded, a disproportion between the muscles on the two sides is produced. The deformity resulting from burns is usually of a complicated nature, as the tension of cicatrices, resulting from loss of substance, is added to the muscular shortening induced by long-continued rest in a certain position.

Deformity similar to wry-neck is sometimes produced by disease of the cervical vertebræ.*

[Cases not unfrequently occur of disease of the lymphatic glands of neck, in which some obliquity of the head is assumed. In more severe cases the deeper-seated glands are involved, with comparatively little external swelling, the resemblance to wry-neck as regards attitude of head being very striking.

Occasionally an attentive examination is required to determine whether disease of the vertebral column, its osseous or ligamentous structures, co-exists. In this case the glandular disease and obliquity of head are but the symptoms of the deeply-seated more urgent affection. As aids to diagnosis among these different forms of head deviation, a few practical rules may be serviceable.

The first circumstance to be ascertained is the existence or absence of voluntary action in the sterno-cleido-mastoid muscle. By this test the absence or presence of paralytic affection may be determined. In the spastic affection volition is not always abolished. The existence of *structural shortening*, if any, should be ascertained by measurement and the touch.

As structural shortening is slowly produced, it points more commonly to spastic, paralytic, or congenital origin, than to the influence of cervico-vertebral and glandular disease. If deeply-seated glandular disease, or vertebral

* The author has seen deformity resembling wry-neck from injury at base of one side of neck involving the clavicle, produced by a gun-shot wound.

disease, be suspected, the co-existence of strumous signs elsewhere may be sought. Disease of ligaments or bones usually occasions more or less well-marked constitutional disturbance, characteristic of strumous disease in other articulations: wasting, paleness, diminished appetite, preference for fluid aliments, skin warmer than natural or relaxed, frequent pulse, disturbed sleep, nocturnal moans and cries, morning perspiration, jurina umentosa; the elasticity of child's disposition, however, permitting exercise and attention to ordinary pursuits, although these are accompanied with early fatigue.

The treatment of wry-neck deviation from disease of vertebral column is conducted upon ordinary principles (in severe cases repose of the part in a suitable mechanical contrivance, see Spinal Curvatures), counter-irritation by tinct. iodinii comp., internal use of steel, quinine, iodine, ol. morrhuæ, and, above all, residence in a pure dry atmosphere.]

Treatment.—Non-congenital wry-neck requires treatment conducted on principles similar to that of other contractures. In the spasmodic and paralytic forms, if the deformity have not existed many years, you may employ the general remedies applicable to disease of nervous centres, already enumerated, seldom with complete success. Should the deformity be recent, and have proceeded from rheumatism, disease of cervical glands, or any local cause exterior to the central organs of the nervous system, the removal of the local affection, by appropriate topical and other remedies, must be effected previously to special treatment of the deformity. If the origin be satisfactorily proved to be voluntary retention of the head on one side, continued vesication or other painful counter-irritation on the opposite side may be resorted to with advantage. I have in two instances witnessed the success of this plan. In all cases except the spasmodic and paralytic, and after subsidence of acute disease, benefit will be derived from [careful] manipulations of the head and neck, exercise

of the weakened muscles, and the wearing of a stiff leather or pasteboard collar, properly padded, and proportionately higher on the depressed side of the neck. In every case in which structural shortening of the sterno-cleido-mastoideus exists, tenotomy of one or both of the origins of the muscle may be effected. Sometimes section of the sternal portion is sufficient, but instances occur in which the cure will not ultimately be effected without section of the clavicular portion. You will remark in these cases, that after the resistance of the sternal portion is removed, the clavicular becomes daily more prominent, and partially retains the deformity. In severe spasmodic cases *subcutaneous* tenotomy is especially useful; it does not always effect a complete *cure*, because the disease resides in the central organs of the nervous system, which tenotomy cannot affect. But the operation, succeeded by appropriate treatment, lessens the energy and power of the muscular contraction, relieves the distressing neuralgic and other pains accompanying this form of deformity, and renders more effectual the use of the mechanical means that may subsequently be required.*

[The author operated one case in an elderly female, who for years had not slept soundly through pain and the incessant convulsive movements of the head. She had in vain endeavoured to obtain rest in an arm-chair. After the operation she slept well; but the case was not otherwise successful, for the spasms returned, and she sank soon afterwards from another disease.]

Tenotomy serves also in many instances to attain the very

* "For certain forms of spasm modern surgery has introduced myotomy; a proceeding which not only removes the residuary effects of spasm, contraction of the muscle (*retraction* of the French, *structural shortening* of the author), but may also exert a beneficial action in calming the nervous irritation during the persistence of the spasm."—Romberg, *opus cit.* p. 289. Elsewhere Romberg points out the unfavourable results of treatment of clonic neck-spasm. Sir B. Brodie many years since observed (*Theory of Local Nervous Affections*, p. 32), that in "muscular spasms remedies are of little avail." Stromeyer, *Manual of Surgery*, 1845, vol. i. p. 268: "Tenotomy relieves spasm in about the same manner that opium relieves other cramps."

important object of enabling the muscles that have been long overpowered to recover a large portion of their lost vigour. I have witnessed the necessity of repeating the operation in a severe case of this nature. Stromeyer relates a similar case. I believe the relief afforded by tenotomy, in very active spastic cases of wry-neck, to be so considerable, whilst the pain and inconveniences of the section are so trivial, that a person thus affected may be readily willing to consent to its repetition.

Tenotomy does not, *à priori,* appear indicated in a paralytic case; yet if structural shortening exist, the section may properly be resorted to, simply as a means of restoring the position of the head, and facilitating its retention by an appropriate cravat.

Various ingenious contrivances have been proposed for maintaining the head in a proper position, either after tenotomy or when the operation is unnecessary: the most notable of these is that of Jörg.* It does not completely answer its purpose. The cravat is more commonly employed. The most simple and effectual consists in encasing the head with a common bandage, and in securing it by means of appropriate slips to the shoulder, or to any part of the dress of the individuals.

[After trial of numerous mechanical expedients for wry-neck, treated with or without tenotomy, the author finds nothing equals the efficacy of a few strips of spread empl. plumbi and a roller bandage. The difficulty ordinarily experienced arises from the form of the parts, the position of which we require to amend readily permitting the bandage or apparatus to become detached. Regarding the trunk as a fixed point, the surgeon seeks to act upon the movable head in such a manner as to cause a rotation of it in a direction contrary to the abnormal deviation. In whatever direction the head be bandaged (omitting the face), the surgeon has to deal with a part more or less globular or oval, *from*

* J. C. G. Jörg über die Verkrümmungen des menschlichen Körpers. Leipzig, 1810.

which, or *around* which, any cap or bandage, when traction is exercised upon it, is prone to glide, the therapeutic effect of the apparatus being at once rendered nugatory. Spread emplastrum plumbi, by its adhesive properties, presents a material which does not readily detach itself. A band one and a half inches broad may evenly and not tightly encircle the forehead and occiput, and be kept in close apposition by a few turns of a roller bandage over it. A similar contrivance should be applied around the waist. A tape should then be sewn to the plaster and the superimposed bandage, immediately in front or behind the ear, according to the existing indication, as regards depression of chin or of occiput, in addition to the main object of rotating the head. The tape should pass diagonally downwards across the neck and chest towards the opposite side, and its lower extremity should be secured to the waistband as much towards the opposite side of the trunk, and as tightly as may be required, to effect rotation of the head. Daily attention to the details of the bandage is necessary. Ordinary dexterity in bandaging on the part of the operator, and a few repetitions of the application, will familiarise both himself and patient with this simple, secure, and effectual mode of mechanical treatment of wry-neck.]

Deformities of the head and neck from burns are rarely remediable. Tenotomy may occasionally be useful; but the plastic operations are more frequently serviceable. I cannot speak of these from my own experience, and therefore shall not detain you longer on this subject.*

[The deformities resulting from cicatrices after burns in the extremities are more favourable, and are often remediable by manipulations and suitable bandages, splints, or mechanical apparatus, or by subcutaneous or open division of the cicatrix, and subsequent gradual extension. The author has never found it requisite to follow Dupuytren's recommendation of making several transverse inci-

* Prof. Mütter, of Philadelphia, has been one of the most successful plastic operators in severe burn-contractures.

sions at short distances throughout the length and thickness of the band. On the contrary, one section across the whole breadth and depth of the abnormal band of tissue, in the situation where it is most free from adhesion to deep-seated structures, has invariably enabled the author to restore the parts whenever attempted, as in the elbow, wrists, and fingers, after the neck, the most common situation of these contractures.

Several transverse incisions in the less organised tissue of a firm cicatrix would appear liable to induce inflammation or death of the intervening portions, by partially cutting off the supply of blood from them. If several incisions were requisite, they should be successively effected, after healing of the section already made, and in proportion as they may appear necessary.

Mechanical treatment is on common principles available in slight cases;* but where the web-like band or the bridle of new tissue is large, much time, and the suffering incidental to protracted wearing of instruments which exercise tension, are saved by section of it. Thus *cure* of web-like burn-contractures of the severest kind, in an extremity, may be effected in six or eight weeks. The operation is painless, as the parts severed are not supplied with nerves, and often almost bloodless, as the blood-circulation is after a time indifferent in new tissue (*tissu inodulaire*). The web-like substance, or the bridle, immediately shrinks, and often in the space of two months entirely disappears.†

Fig. 79.

Elbow contracted by web-like band resulting from burn.

* "C'est souvent dans les cas de cicatrices à la suite de brûlures que les appareils mécaniques peuvent rendre de grand service." — *De l'Appréciation des Appareils Orthopédiques*, par E. Chassaignac, p. 127, Paris, 1841. Chassaignac relates the success thus obtained by Dutertre in 1814.

† July 1848.—A young lady, aged 15, resident in a part of Australia remote from medical aid, was eight years ago severely burnt on the left side of the face

Fig. 80.

Deformity of foot from contraction of cicatrix after burn, see p. 200.

In some burn-contractures the contracting band is less web-like, resembling rather the cicatrices which occur after suppuration, as in fig. 80.

Even burn-contractures of more unfavourable aspect, those in which adhesion of surfaces exist, and the operative treatment of which is usually considered to be less successful, admit of relief.

The treatment of a case of this description may require to be spread over a long period, in consequence of the necessity of avoiding several suppurating surfaces in the palm at the same time.

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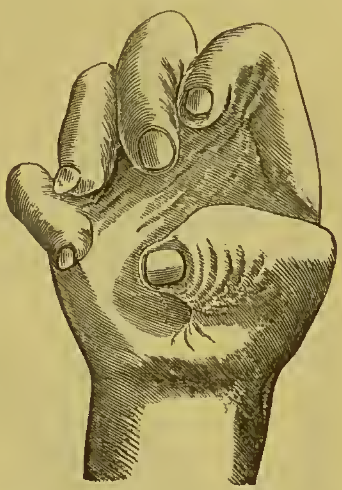
and chest and on the left arm. The burns of the chest and face healed in a few weeks; but the suppurating surface, extending from the axilla to palm of hand, which had been complicated with sloughing, did not cicatrise until many months after the accident. She has since been completely deprived of the use of the elbow and wrist, which are contracted, the elbow being flexed to a right angle, the wrist flexed and pronated. Opposite the elbow is a firm, whitish, web-like substance, in parts half an inch in thickness, originating from the middle of the upper arm, reaching to the wrist, where it spreads out into two portions—the one inserted into the ulnar region of the palm, the other into the radial portion. The movements of the fingers are tolerably free. The father, by profession a civil engineer, had displayed much ability in the construction of mechanical instruments for extension of the elbow, and was not a person to be daunted by slight difficulties; but he had never been able to make more than a temporary impression upon the band of adventitious tissue. The hand and arm were from disuse much smaller than the sound member. The uncommon thickness of the abnormal band, and its numerous firm connexions with the deeper structures, indicating that the original burn had penetrated to the fasciæ and muscles, rendered it improbable that manipulations and mechanical extension of elbow would remove the contracture. Th following operation was consequently performed, July 13, 1848, with the assistance of Mr. Hamilton and Mr. D. Nelson of Acacia Road:

The elbow was rested upon a table, one assistant holding the shoulder, whilst another stretched the abnormal band by depressing the fore-arm. An ordinary sharp-pointed bistoury was passed through the web immediately above what was considered to be the tendon of the biceps, and the web completely

In that represented at fig. 81, the author began by detaching with a scalpel the little finger from the palm, using extension upon the phalanges during the proceeding. He was gratified at finding that the finger could be straightened, leaving a wound extending throughout the long axis of the finger, and nearly midway up the palm. The laxity of tissue in the palm permitted the approximation by sutures of the palmar portion of the wound, but little closure of that along the finger could be effected. It was hoped that by granulation this portion would close without recontraction. A month after the operation reunion was complete, the finger having been kept extended upon a whalebone splint. A similar operation was performed upon each of the re-

Fig. 81.



Contracture of hand after burn. The whole of the fingers and the thumb were adherent by the entire width of their palmar surfaces, some more completely than others. Thus the thumb and forefinger were firmly agglutinated to the palm to within half an inch of their terminal extremities, whilst the third, fourth, and fifth fingers were adherent quite to the extremities. The patient was a boy, aged eleven. The burn occurred six years before the period of the operation resorted to for restoration.

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severed from behind forwards. The contracture instantly diminished upwards of one-half. A few dense fibres were felt in the resulting wound opposite the elbow; these were severed by a touch with the point of the bistoury, with the effect of further reducing the contracture; whilst the joint appeared so supple, that no doubt existed that if it were advisable the elbow could at once have been entirely straightened. An ounce of venous blood oozed from the divided surface, which was about four inches in length, and in parts an inch and a half wide. The sides of the wound were brought together as much as possible by a few ligatures, to the extent of reducing the surface one-half. Oiled lint was applied as dressing, and the limb bandaged upon a splint in the new position, but without exercising any tension upon the parts. It is unnecessary to publish the details of the case during the cicatrising and extending process; it is sufficient to state, that a linear scab only remained at the end of the eighth

maining fingers, the entire treatment having occupied about six months. The accompanying drawing, fig. 82, represents the amount of improvement obtained. At the present time (Jan. 1853), eight months after the operation, the power and movements of the thumb are perfect, the fingers are almost perfectly free in their movements; he can grasp small as well as large objects with facility, and may truly be said to have benefited by the operation to the extent of regaining a hand.

Fig. 82.

This drawing represents the hand, fig. 81, after the treatment.

The little and middle finger present on their palmar surfaces a cord-like cicatrix prone to contract. The patient has been recom-

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week; a fortnight later this had become detached; the elbow was perfectly straight and flexible. The wrist did not require operation, as the relaxation afforded by elbow-operation relieved much of the flexion of the wrist; the remaining flexion and pronation was overcome by manipulations and use of the hand. On Sept. 6, 1848, she was able freely to bend and extend both elbow and wrist, and employ the hand at the piano. The author has since frequently seen this young lady; the restoration has been perfect and constant. No portion of the band remains.

The following case occurred in a younger subject: the web (see fig. 79) was as extensive as in the former case, but thinner and less dense. The subject, a girl, aged 7, who had been badly burnt two years before, was seen, in consultation with Dr. Aitken, Kingsland, May 1850. The left arm was contracted to a right angle; the band was divided as in the above case; the elbow was immediately straightened without difficulty; a few drops of blood only flowed. The more superficial nature of the case enabled the edges of the wound to be brought almost into apposition, with the assistance of a few ligatures. Cicatrisation was completed within fourth week, a narrow,

mended to wear at night, during the growing period of life, a five-fingered metal hand-splint, for the purpose of preventing re-contraction. Under any circumstances of neglect, he cannot relapse into his former state.*

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smooth, shining scar alone indicating the situation of former band. The function of the arm was entirely restored within six weeks.

Mr. Adams, of the Royal Orthopædic Hospital, very recently shewed me a model of a similar burn-contracture of arm, successfully treated there by Mr. Tamplin, by twenty weeks' incessant mechanical stretching.

* A fourth case of burn-contracture is added, for illustration of the extent to which restoration may be effected without dissecting out of cicatrix or transplantation of integument. The author was consulted by Mr. Lallemand, of Macclesfield, respecting a young lady whose left hand, after a severe burn, was helplessly contracted. The position of the hand resembled that represented p. 109. The contraction of elbow was inconsiderable. Traces of the burn were visible both on the anterior and posterior surfaces of the arm and wrist. The cicatrix on the back of wrist represented a thin glistening skin spread *loosely* over it, whilst on the front of the wrist and fore-arm were two thick indurated bridles ; the smaller extending from above the inferior extremity of ulna towards the elbow; the larger and broader, springing from opposite the base of the thumb, traversed the fore-arm to the elbow, uniting the smaller bridle with it, and serving to limit the movements both of wrist and elbow. It also sent a prolongation into the palm, which effectually prevented the use of the thumb. The front of the wrist was so completely occupied with dense cicatrix of fibro-cartilaginous hardness, as to occasion doubts of success without transplantation of integument from the posterior part, where it existed in abundance. The author determined to sever the principal band on the radial surface of the wrist, to detach the integuments on the radial side of the gap made by the section of the band, and endeavour to bring some of the loose integument with the aid of ligatures from the posterior towards the anterior aspect of wrist, and trust to mechanical extension for elongation of that band which extended from the hypothenar upwards.

The operation was accordingly performed (August 25, 1851), and the wrist gradually extended during cicatrisation, which took place uninterruptedly in three weeks. At expiration of five weeks the wrist was fully extended and supinated ; the palmar band, which firmly bound down the thumb, also yielded considerably to the constant stretching employed ; but more complete liberation of this part was effected by dividing the portion of the band which extended from the thenar towards the extremity of the thumb. The band over the ulna also gradually yielded, whilst the elbow was liberated by the operation upon the larger band and by mechanical extension. The entire restoration of the form and movements of the wrist and thumb was effected

The author's experience of the division of burn-cicatrices is so favourable, that he is of opinion that greater reliance upon this plan, combined with painstaking mechanical treatment, will complete the abandonment of the mode formerly advocated by Earle and Dieffenbach of dissecting out a cicatrix, and will greatly reduce the necessity of the awful baring of surface required for successful transplanta-

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within eight weeks. She now began actively to use the hand during the day-time, wearing the splint at night only. Four months after the operation, all bridles having disappeared, the volar surface was perfectly smooth; and the hand, although it had been entirely disabled during eight years, was free from deformity, and restored to usefulness. The share which the partial detachment of integument had in filling up the gap formed by the division of the bridle is shewn by the form of the cicatrix resulting from it. The gap after the operation was about two inches and a half broad, and presented the following outline . The smooth cicatrix had the following shape , shewing that the endeavour to bring some integument from the side had succeeded. In order to prevent recontraction, this case was kept under observation some months after restoration of form and movements was effected. Mr. Lallemand has since informed the author that no relapse has taken place.*

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* The case, fig. 80, p. 196, was successfully operated by Mr. Gowlland, by open division of the cicatrix; and illustrates the promptitude with which restoration may be obtained. He has kindly furnished me with the following report of the case:

"At the time of the operation the outer side of the foot was forcibly drawn up, and entirely prevented the child from attempting to walk. On August 3d, 1852, the tight band on the outer side of the foot (represented in fig. 80) was divided by means of a sharp-pointed bistoury inserted from within outwards; a few fibres of condensed cellular structure could be felt at the bottom of the wound, which were carefully divided from without inwards, and the edges of the wound brought together in some degree with sutures. Water-dressing, together with some simple ointment, soon healed the sore; during which time the foot was kept fixed in a proper position to counteract the tendency to recontraction.

"After cicatrisation was complete, a laced boot, with a small spring on the inner side of the leg, was worn instead of the splint previously adopted; and the mother tells me that her child, now two years and a half old, can trot about as well as most of her little playmates of the same age.

"The shoe, with its inverting spring, is constantly worn, and the foot is directed to be bent downwards and inwards three or four times a day, in order to stretch the cicatrix; so that up to the present time (now five months since the operation) there is no appearance of any return of deformity."

tion of skin in severe neck and other cicatrices. It may appear preposterous to redivide parts, the healing of which (on an extensively burnt surface) the surgeon has patiently toiled for months to accomplish. But the circumstances during the difficult cicatrisation of an extensive burn, and at the expiration of a year or more after the cicatrisation, are widely different. The shock experienced by the system at large at the time of the accident, the exhaustion from want of repose, from suffering, from symptomatic fever, from an extensively suppurating surface, have combined to reduce the reparatory efforts of the economy to the lowest point, so that cicatrisation often creeps on but slowly, and the surgeon witnesses almost with satisfaction his attempts to prevent deformity abortive,—attempts which his duty led him to adopt, but which, by retarding even that feeble cicatrising process, threatened renewed or prolonged mischief to the general health. He is justly too thankful to obtain cicatrisation with deformity of one part, as the price of restoration to bodily health and activity of the remaining parts. A year or more later, circumstances have greatly altered; the deformity may have become aggravated, but the general health is restored, and the comparatively trifling, painless surgical operation required in section of one or more bands of cicatrix, to be followed by gradual or immediate replacement of the part, is not only borne with facility, but is justified by the greater restorative and plastic energy possessed by the constitution. It has been a source of gratification to find that the same tendency to recontraction is not manifested as immediately after and during the original healing. In the first instance, the necessary disuse of the part permitted an easy conquest to the cicatrising and contracting force; in the second instance, experience has demonstrated that use of the part is an effectual opponent to relapse.]

LECTURE XII.

Rachitic distortions—Rickets in gencral—Causes of; influence of unsuitable diet—May affcct not only bones, but cvery tissue in every part—Gcnu valgum, or knock-knee, from rachitis, from excessive standing—Treatment, medicinal, dietetic, mcchanical, operativc.

RACHITIC DISTORTIONS.

WE proceed to consider the third elass of aequired deformities (p. 11); namely, those serious deviations from the normal form which are peeuliar to rachitis or rickets, and those less eonsiderable distortions whieh are regarded as ineidental to a debilitated eondition of the system. It is not my intention thoroughly to diseuss the pathology of raehitis, but only so mueh of the subjeet as will enable you to understand the mode of produetion of the deformity and the indieations of treatment. The important eharacter of riekets is that of softening the framework of the system; henee a eollapse of eertain parts, a sinking of others beneath the superineumbent weight, and a liability to alteration from the natural shape through the aetion of the museles attached to them. I inelude in this eategory the deformities supposed to arise from debility, as this eondition of system is in some of its effects allied to raehitis. Certain deformities that are supposed to arise from improper attitudes and vicious positions of the limbs may, with equal propriety, be here eonsidered.

Numerous infants, born perfectly sound, about the period of dentition, or that of weaning, suffer from gastro-intestinal derangement, and, in spite of abundanee of food, beeome debilitated, and at the period when ehildren usually attempt to walk are observed to make no use of their

limbs. In these cases the effect of the gastro-intestinal disturbance is to impair the digestion and assimilation of food, the maintenance of the structure, and the growth of the several parts of the animal economy.

Many infants, equally robust at birth, become debilitated as their age increases in consequence of the poorness of the milk received from the parent, produced either by derangement of health, through luxurious and enfeebling habits, and perhaps through constitutional debility, as among the rich, or induced by insufficient food and other causes, as amongst thousands of the poorer mothers of this metropolis. Whatever be the remote cause of the debility in question, the proximate cause, imperfect assimilation of food and impaired nutrition of the frame, is the same. This form of debility may reach so considerable a degree as to constitute a true cachexy. It is not my purpose to enter into a detailed consideration of the opinions entertained respecting the mode of operation of the causes of rachitis compared with the influence of the same causes in the production of tuberculous and other cachexiæ. I may, however, remark, that an interesting field for research is offered by rachitis to the organic chemists; and it is not improbable that we are approaching (1843) the discovery of the true nature of the deterioration that the blood undergoes in this disease.*

* Since the delivery of the above lecture the author was shewn by M. Guerin, at Paris (in 1844), a series of preparations and drawings intended for the illustration of an elaborate and valuable work about to be published on this subject. M. Guerin has artificially iuduced rachitism in domestic animals, by subjecting them to the influence of an unsuitable diet; and has arrived at the conclusion, that rachitis results from *improper* food, tubercular disease from insufficiency. This opinion is very plausible; and if correct, is calculated to lead to improvement in the management of infants, and prevention of rachitis. In the absence of the detailed reasons on which M. Guerin's opinion is founded, it may still be asked, whether improper food does not act in the manner described in the above lecture, by disturbing the digestive functions, and inducing results identical with those of insufficient nourishment?

[Casual observation upon domestic animals has shewn the author that rachitis is a common disease in the young of the canine race when fed upon farinaceous instead of animal food, and that prompt improvement occurs when the diet is changed from biscuits to meat. A large proportion of infants in this metropolis are reared upon a scanty animal milk-diet from the mother's breast,—the remaining food requisite to satisfy the child's hunger being furnished from the vegetable kingdom, *i. e.* the various farinacea. The order of dentition — the early development of incisors in infants — indicates a greater adaptation to animal than to vegetable diet. Observation of the diseases of children, and of the beneficial effects of animal diet, confirms what comparative physiology suggests.

The fear of mixing "the two milks" during infancy, and the fear of grossness during childhood from animal diet, deter not only the ignorant, but sometimes highly educated mothers, from following the impulses of nature in giving to the young plain and wholesome articles of diet, of which they would readily partake. The author's opportunities of observation of infants and children, in public charities and in private practice, has convinced him that from the operation of the above fears thousands of children are annually starved into rickets, either into the rarer severe forms of the disease (universal rachitis), or the numerous slighter manifestations of it (" weak ankles," " weak knees," " pigeon-breastedness"). The author may be permitted to state that even many medical men are influenced by these fears; and in the case of infants, when " artificial" food is compulsory, advise a largely watered milk or milked water, when they should recommend a food containing as great a proportion of animal nutritive matter to the containing water as human milk does.

The younger the infant which is deprived of the breast, the less is the aptitude to digest and assimilate farinaceous

substances; and the greater is the necessity for an amply sufficient supply of slightly diluted pure unskimmed milk of a domestic animal.

The extent to which insufficient nutrition and rachitis is sometimes met with, even amongst wealthy families, illustrates the danger of too-ready abandonment of the maternal instinct in the management of children, and the substitution for it of a little book-learning. The author has been consulted in families in which, for an extreme example, there were five or six rapidly growing daughters denied the use of meat more than twice a week, entirely debarred the use of salt or of wholesome fruits, even restricted in the quantity of bread; all in consequence of morbid anxiety to cultivate temperance in food, to avoid grossness and apprehended stomach-ailments.

The author's attention has been directed to such instances of mismanagement by every child in the family having presented some signs of rachitis. In the rearing of children it should never be forgotten, that the tolerance even of excess in them is very great, provided they have abundance of air and exercise. The evils of excess are spontaneously counteracted in childhood by several of nature's efforts for that purpose, *e. g.* the easy regurgitations in an over-fed infant, and the comparative habitual looseness of bowels in early life: but the evils of under nutrition are not so promptly discovered; they are often latent (to the inexperienced eye), often insidiously progress until a cachexia, rachitis, or tuberculosis manifests itself. It is scarcely necessary to add, that amongst the remote causes of rachitis, as of disease in general, impurity of air, excessive humidity, uncleanliness, hereditary predisposition, other diseases, &c. should be enumerated.]

Now, although we do not understand the intimate nature of the disorder of assimilation, it has long been known that in rachitis the osseous system undergoes a series of morbid changes, characterised, in the first instance, by deficiency of calcareous matter, hence dimi-

nished firmness. This is ultimately succeeded by morbidly increased calcareous deposit, unnatural density and bulk, with the conditions technically denominated *eburnation.* If rachitism occur so early in infantile life that the bones have never become perfectly ossified, an arrest of their development may be said to have taken place; but if it occur at a later period, removal of the calcareous matter already deposited is supposed to ensue, and the bones undergo softening. In the great majority of instances—perhaps in every instance—the rachitism consists in arrested development. I do not remember having witnessed a case that has satisfactorily been proved to have originated subsequently to complete ossification.

Rachitism is not solely a disease of the osseous system, but its effects are in this part more obvious, and therefore have been longer noticed. My own opinion is, that every tissue of the frame is involved in the loss of *tone* and firmness,—the bones, ligaments, the involuntary and voluntary muscles and their appendages, the membranes, the glandular organs. We cannot doubt the evidence of our senses respecting the organs within reach of sight and tact; and should we not anticipate that those more remotely situated—the nervous system, for example—are similarly affected? In truth, we may regard the greater number of cases of chronic hydrocephalus* as manifestations of rachitis. We possess the solution of the reason of the universality of rachitism in the deterioration and the poverty of the blood in some of the ingredients essential to the proper growth of the frame. I would willingly dwell a few moments longer on this topic, as I conceive the attentive watching of the early stage of rachitism, the precursory signs of rachitic deformities, especially important to the medical practitioner. The treatment of rachitic deformities is a successful department of orthopædy; but you will be better satisfied if, on the appearance of the precursory signs, you should be enabled to prevent deformity.

* Hereditary predisposition to cerebral disease having pre-existed.

Rachitic deformities rarely become the subject of attention before the child attains the age of [fifteen or] twenty months or two years, and sometimes you will not be consulted until much later; whereas the precursory signs, consisting of slightly enlarged head, weakness of the back, pallid face, flabby though bulky limbs, tardy dentition, tumid abdomen, with continued slight derangement of the stomach or bowels, manifest themselves from the sixth to the twelfth month. Soon the wrists begin to enlarge, the ribs to flatten, the abdomen becomes protuberant, the tibiæ become curved, and the child remains incapable of standing. This is the second stage of rachitis, in which deformity is already apparent. In the next stage more numerous articulations become distorted; the inner ankles sink beneath the weight of the body, the curvature of the leg-bones increases, the knees project inwardly and "knock together," the thigh-bones curve forwardly, flexion of the pelvis upon the thighs, and lordosis or curvature forwards of the lumbar vertebræ, ensue.

The disproportion between the bulk of the abdomen and the thorax now reaches its maximum; the first is double or treble the natural size, the thorax exceedingly small, the sides of the chest flat, or even greatly indented. The sternum is often projected forwards, or its lower extremity with the cartilages of the left ribs elevated, marking the unwillingness of the heart to bear compression. Indeed, the pulsations of this organ are often visible over a large extent of surface. In extreme cases the clavicles, the humeri, and the bones of the fore-arm, are curved to a considerable extent. The upper portion of the vertebral column often suffers; but this subject shall be deferred until the lecture on spinal curvatures. It is not surprising that with this amount of impeded development and deformity, the stature of the individual should be very diminutive. Here are drawings of the entire frame of rachitic individuals at several ages, in which you perceive the various distortions I have enumerated. One, for example, fig. 83, of an indi-

vidual nineteen years of age, less than four feet in height; and another (fig. 84), of a boy aged eight years, thirty inches only, the head alone forming nearly a fourth part of the height.*

The distortions of the upper extremity do not se-

Fig. 83.

Outward curvature of thigh and leg bones, and consequent flat-feet.

Fig. 84.

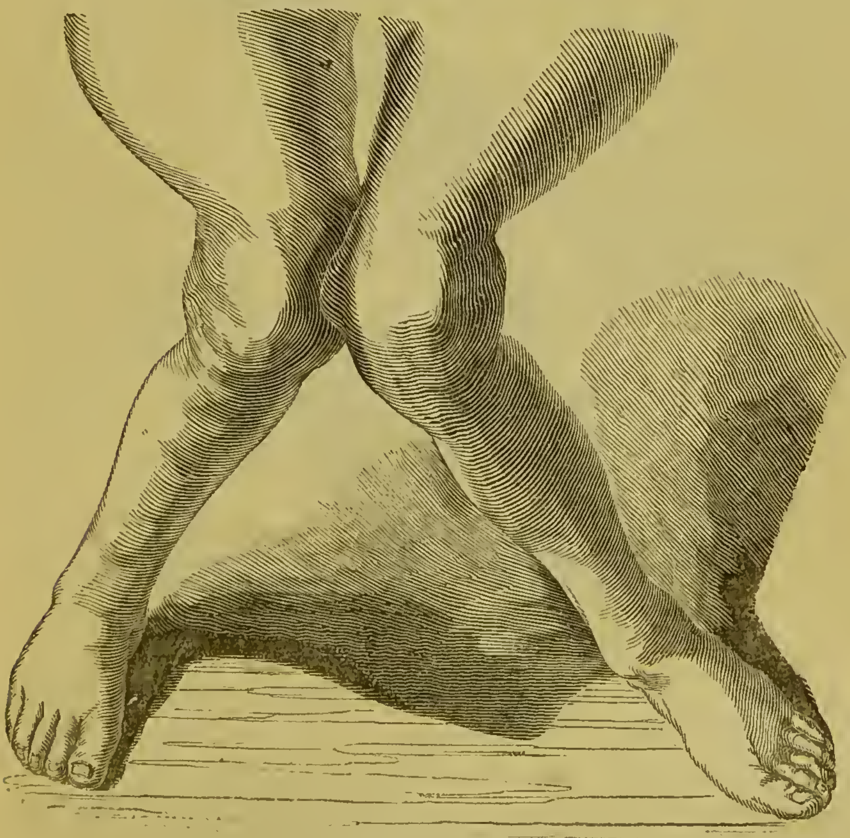
General rachitic deformity. The disproportionately large development of some parts and arrested development of others is conspicuous.

riously affect the functions of those parts, and therefore seldom merit any special treatment. The most frequent rachitic deformity of the lower extremity, and that which more frequently attracts attention, is that popularly denominated *knock-knees, in-knees,* and described by professional writers under the name of genua valga.

* See a most valuable paper in *Medico-Chir. Transactions,* "On the effects of rickets upon the growth of the skull," vol. xxvi. 1843, by Mr. Alexander Shaw, surgeon to the Middlesex Hospital.

The various models before you will illustrate the numerous grades of this affection, which consists, as the popular designation implies, of an inward inclination of the knees. A single knee may be slightly affected, or the deformity of one knee may reach an extreme degree, the leg being everted almost to a right angle with the thigh, the opposite member remaining straight; or when both knees are affected, one of them (usually the left) is more severely distorted than the other, as in this model (fig. 85).

Fig. 85.

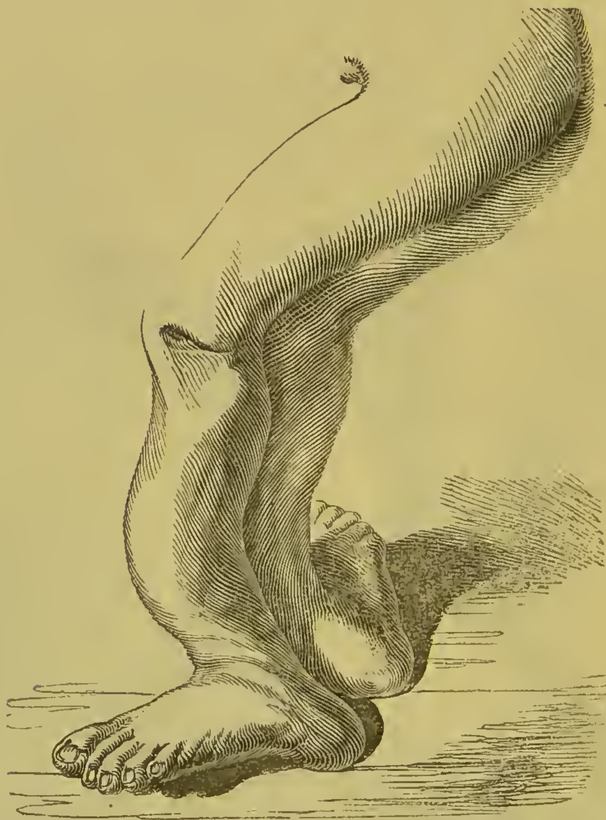


Severe Genua valga, or in-knees.

A slight grade of this deformity may present itself as early as the age of twelve or fifteen months; it sometimes diminishes so considerably with increasing general strength,

that it ceases to attract attention, or the limb entirely recovers. It is, however, often considered to be cured, when an attentive examination demonstrates the traces of its existence. When neglected, the deformity increases

Fig. 86.



Extreme curvature of leg bones and extreme flat-foot (*Rachitic valgus*).

gradually, difficulty in locomotion is experienced, and it often becomes in time impossible. I have been consulted concerning many patients with the highest grade of this affection, in whose early infancy their parents were assured the "weakness" and deformity would spontaneously subside, that the children "would grow out of it." I advise you not implicitly to trust to nature in these cases. When once the straight line of the limbs is to any considerable extent destroyed by this inward inclination of

the knees, the assistance of art is imperatively required for its relief. The affection commences by relaxation of the ligaments and muscles surrounding the articulation; the inside of the knee is less protected than the outer side, hence an inward yielding. This is accompanied either with almost imperceptible curvature of the leg-bones, or with extreme curvature, as in this model (fig. 86), and often with inward inclination of the ankle. The internal condyle of the femur becomes very prominent, and sometimes disproportionately enlarged, whilst the development of the external condyle is impeded.

Fig. 87.

Arrangement of bones in Genu valgum.

[The only special anatomical illustration of Genu valgum the author has met with is contained in Sandifort's *Museum Anatomicum*, vol. iv. Plate 29.* It represents (fig. 87) the characteristic inversion of the knee, the disproportionate development of internal condyle, or rather the atrophy of the external one, the disappearance of articulating surface on the front of condyles consequent upon disuse,

* [Sandifort attributes this example of Genu valgum to hydrops articuli, from which the softening and subsequent hardening of the bones may possibly have proceeded; but his description corresponds with advanced rachitic Genu valgum. He says, "Forma nimirum ossium, ubi articulationem componunt, maxime est mutata; æque ac si hæc ossium extrema in prima morbi periodo, quando emollita fuisse videntur, graviditate corporis compressa, præternaturalem hanc acquisiverint figuram, quam dein, duritie ossis rursus aucta, retinuerint, dum post illud tempus marginum superficierum articularium excrescentiæ procul dubio exortæ sunt."]

—habitual flexion of the knee (as in severe cases) having been combined with the inversion. The part formerly occupied by articulating surface is thickened and everted from osseous deposit. The articulating surfaces of the tibia were much degenerated and inclined backwards, especially the external one, causing a kind of sub-luxation.]

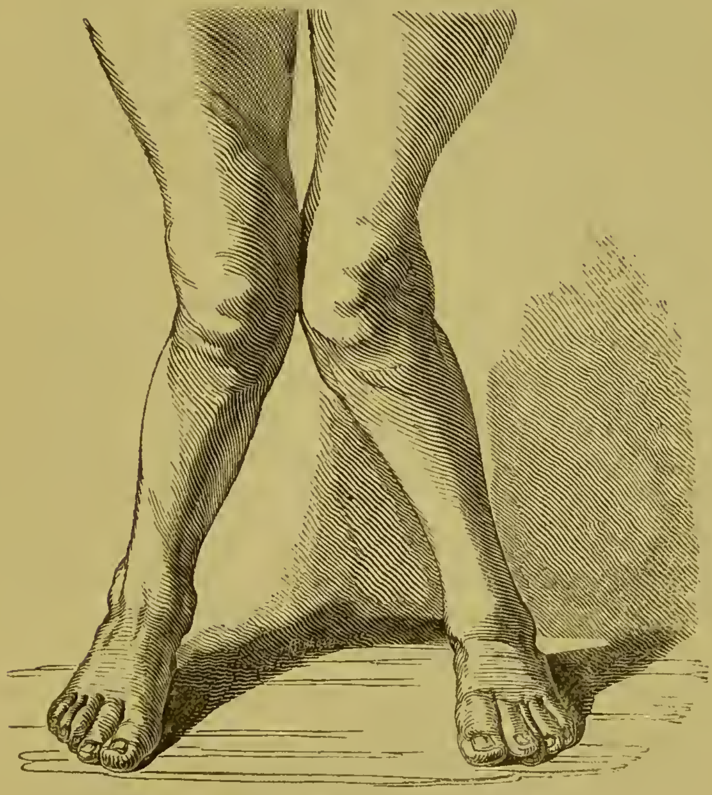
The head of the tibia also appears unusually large. Sometimes its internal surface is merely prominent; at other times, a remarkable projection, quite angular, like that of a badly united fracture of the tibia, is observed two or three inches beneath the internal and upper edge of this bone. After considerable duration of the deformity, certain fibrous tissues on the external or concave side of the joint become contracted and undergo structural shortening. These tissues consist principally of the biceps, the attachment of the vastus externus to the head of the tibia, and the external lateral ligaments of the knee.

A deformity similar in form (fig. 88) is frequently witnessed in youths who have been too early employed at occupations requiring much standing or walking, as in shop and errand boys, printers, smiths, &c. Constant standing in one position is more prejudicial than even undue walking. Occasionally it arises from, or rather it is first noticed after, a sprain, a fall, or other accidental injury of the knee. Genu valgum may coexist with every other rachitic deformity. Both knees sometimes incline in the opposite direction (fig. 92), or Genu valgum may exist, which by its pressure against the opposite knee, occasions an outward yielding of the member.

Treatment.—General medicinal and dietetic treatment is essential in this, as in every rachitic deformity, so long as the rachitic cachexy exists; but when this constitutional debility is removed, and the resulting deformity alone is present, the remedies specially directed to the removal of the abnormal form are available. These mostly consist of mechanical instruments; and occasionally tenotomy may be serviceable.

In the treatment of the incipient stage of this affection there are, therefore, three indications to be held in view:

Fig. 88.



Genua valga produced by excessive standing during adolescence.

1. the cure of the constitutional derangement; 2. the removal of the superincumbent weight of the body, which tends to increase the deformity; and 3. the straightening of that already existing.

The first indication may be effected by administration of preparations of iron and iodine [ol. morrhuæ], removal to a purer atmosphere, country air, or the seaside, by greatly restricting the child in the quantity of fluids drunk, by encouraging the use of animal food. Rachitic children, or those not actually rachitic, but weakly, usually take much fluid, and are very averse to animal food. Sometimes a mo-

derate allowance of wine and water, or of diluted malt liquor, may be recommended. Occasionally gentle laxatives may be needed. The ponderous abdomen may be much lessened, and the functions of the alimentary canal much benefited, by a proper bandage. The support thus given to the abdomen prevents the great distension of the alimentary tube, and enables the child better to maintain an erect position. It is further useful by limiting abdominal and exciting thoracic respiration; a circumstance of importance, by its contributing to removal of the flattening of the ribs.*

The second indication may be fulfilled either by the child not being permitted to endeavour to walk, or by affording mechanical support for the purpose of facilitating exercise.† When the tendency to deformity is considerable, and the child very young, or confirmed rachitis exists, the general debility is so great, that you may advantageously recommend that the erect posture be not for a moment permitted, notwithstanding that the child instinctively endeavours to support itself. The child may be constrained to amuse itself on the floor. Carriage-exercise in the open air should be resorted to as often as the weather may permit. But after infancy the difficulty of restraining a child from attempting to walk becomes insuper-

* The transverse diameter of chest is sometimes reduced to one-fourth. When the flattening of the ribs has been considerable, the author has been accustomed to recommend, with advantage, simultaneous exercise of both arms of the little patient in pulling a couple of lines working over pulleys, with small weights attached (a many-coloured doll, or other toy, for example). Each line and pulley should be fastened at opposite ends of the apartment, in order that both pectoral and serratus muscles of the child, sitting on the floor in the middle of the room, should be equally excited into activity. Frequent compression of the chest, with the hands of a competent person, in the antero-posterior direction is useful. Jalade-Lafonde (*Recherches pratiques sur les principales Difformités*, deuxième partie, p. 164, Paris, 1829,) recommends this to be done at the close of expiration, in order to necessitate lateral expansion during the succeeding inspiration. See also Dupuytren "On lateral Depression of the Walls of the Chest," Sydenham Soc. 1847, p. 383.

† See Lecture on Spinal Curvature.

able; the rachitic cachexy is probably diminishing, the members becoming stronger; still, when erect, a considerable yielding of the joints presents itself. The question arises, will you still prevent this child from taking exercise? Observation teaches that if the knees yield from the straight line the deformity tends to increase, and that before the rachitism will have completely subsided, before the bones, ligaments, and muscles will have acquired the natural strength, structural shortening of certain structures on the outer side of the articulation will have ensued; in fact, that before the time the constitutional disorder is at an end, the deformity will have become confirmed. Exercise in the open air is so important a means of improving the general health of these patients, that the propriety of adapting mechanical support to the limbs, and thus enabling the child to profit by the air, will suggest itself to you. You must weigh the advantages and disadvantages of mechanical support. My experience enables me to affirm, that the benefit of proper mechanical support is so considerable, that you should unhesitatingly have recourse to it at this stage of the disorder. No one would approve of encasing the limbs of a healthy child in irons, any more than of the administration of mercury or arsenic to persons in good health; but in neglected genua valga of a certain severity, the increase of the deformity is certain, and more often mechanical means will afterwards be required, when they can no longer so effectually assist.*

The third indication, that of removing any contraction and structural shortening, or permanent deformity, should be accomplished by bandaging common straight splints on the outside of the knees; these should be worn night and day, and removed at certain times for the sake of cleanli-

* When projection of abdomen and hollowness of loins exist, it is important that the irons or splints should be connected by a band extending behind the pelvis, by means of which a comparatively upright attitude is at once obtained.

ness, for the use of frictions with manipulations directed to the maintenance of a flexible state of the articulations, otherwise the joints will become rigid, and much pain be produced in the restoration of mobility. In severe cases common splints will not suffice; you should then use irons attached to shoes.*

* Irons are only effective in the treatment of severe Genu valgum when they are constructed without movements opposite the knee-joint. The prejudice against splints or irons has so greatly declined since the above was written, that in the present day, 1853, it appears unnecessary to dilate upon the advantages of mechanical treatment of these deformities.

The following case will illustrate the difficulties attendant upon successful treatment after adult age of severe Genua valga complicated with other deformity:

"*Case of complete inability to walk for many years from contraction and inward inclination of both knees, with distortion of the feet resembling Talipes varus. Treatment mechanical.*

"August 1839. Miss ***, æt. 21, stated to have been unable to walk since five years of age. On inquiry, ascertained that a weakness of the knees had existed from earliest infancy, and had increased until locomotion became altogether impossible. Subsequently a distortion of the spine is reported to have occurred; for which she has been seven years under treatment in the constantly recumbent position by a well-known spinal physician. The lameness is so considerable that, even when supported by two assistants, the patient is unable to make a single step. This utter helplessness as regards locomotion arises more from distortion of the knees than of the feet, although the position of the latter corresponds with non-congenital Talipes varus. The foot-deformity appears to have been induced solely by long-continued disuse of the limbs, and consequent preponderant action of the muscles on the posterior and internal aspects of the limbs. No evidence of its dependence upon spinal disease exists.

"In the recumbent posture the appearance of the limbs corresponds with fig. 85; but on the attempt to stand, the knees are not only thus greatly inverted, but are much bent; the thighs at the same time being flexed on the pelvis, and the lumbar region much hollowed. The stature of the patient is, in consequence of these flexures, diminished. Little voluntary power in the muscular structures of the lower extremities exists, even in the recumbent posture. During extension of the knees the ankles diverge as before described, but on raising the knees towards the abdomen the ankles approximate. Tension of the tendons of the biceps of the fascia lata and external lateral ligaments of the knee, constitutes the more prominent cause which maintains the distortion of the knees.

"The friends of this young lady having objections to any operation,

I have mentioned that this deformity occasionally occurs in adolescence, and cases present themselves that have existed since infancy. The shortening and rigidity of the tissues on the outer side of the knee are often so unyielding, that you may ineffectually devote months to the mechanical treatment (see note, p. 220). In these cases you may accelerate the *cure* by subcutaneous section of the biceps tendon, the inferior termination of the vastus externus, and the bands of fascia in this situation. A great improvement speedily succeeds the operation. After cicatrisation the mechanical treatment should be pursued with the same diligence as necessary without the operation. In a few weeks all resistance to straightening will be removed.

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the treatment was undertaken by mechanical means. At the expiration of three months the inversion of knees was overcome so long as they remained extended, but when flexion was attempted a tendency to recurrence of the eversion of the legs became evident. Six weeks later, the resistance offered to the replacement of the feet by the gastrocnemii and adductors was sufficiently overcome to permit the wearing of steel supports, in which exercise might be attempted. Many years having been passed in the recumbent posture, the circulation of the blood had become adapted to that position of the body only; great debility of the whole muscular system existed, and the patient, so long accustomed to one position, shrank with more than common timidity and nervousness from the attempt to stand upright. The necessity of caution was anticipated; but notwithstanding the utmost attention, the previous administration of wine to support the action of the heart under the increased labour devolving on it during the erect position of the frame, vertigo and syncope attended the first effort. Many days elapsed before the patient, even with the assistance of friends or crutches, could support herself upright and attempt to make a step; but before the expiration of six months from the commencement of the treatment, I had the pleasure of witnessing so great an amendment, that my patient could with slight support stand erect, placing the entire soles on the ground, and even walk a few paces. With the aid of crutches, locomotion about the house and garden was effected for the first time since early childhood.

"At the expiration of eighteen months she laid aside the cumbrous irons at first indispensable; and wearing a slight support to each knee, the use of which had been recommended as a precautionary measure for some time longer, she is able to walk without lameness a distance of two or three miles.

"Two years afterwards this patient visited me, wearing a lace-stocking at the knees on account of the uncommon laxity of the joints, and tendency of

Mechanical support is required for one or two years afterwards, until the articular surfaces have become adapted to the change in their relation, and until the debilitated muscles have acquired strength.*

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some degree of Genu valgum to become permanent. On examination I perceived that perfect adaptation of the articular surfaces of the knees to the altered form of the limbs had not yet occurred; for, supposing the annexed diagram, *a b*, to represent the relatiou of the (right) thigh and leg before the treatment was commenced, the relation of the leg to the thigh immediately after the Genu valgum was overcome was that represented by the dotted portion of the diagram.

"From this diagram it appcars, that before the treatment the part corresponding to the internal condyle only impinged upon the internal portion of the articular surface of tibia, the remaining part of the articulating surface of the femur having been separated from the tibia by a triangular space. Iu the act of walking, therefore, unsupported by instruments, a continual tendency to relapse into the old position existed. Compare fig. 87, which relates to opposite leg. It was at that period an interesting question, whether, as the patient had reached puberty, the articular surfaces of the femur and tibia would adapt themselves to their altered relation. Confiding in the extraordinary powers of adaptation manifested by articular surfaces as after treatment of severe club-foot, I trusted, that although the growth of the body was completed, this beneficial result would in time take place, if the position of the legs in the perpendicular axis of the limbs could by mechanical aid be preserved. This result did occur. For several years afterwards I received an occasional visit from this patient. She ultimately lost all trace of Genu valgum and of undue laxity of articulations.

"So great had been the laxity of the integuments and ligaments over the internal part of the knee-joints, that I had recourse to the expedient of an artificial contraction in those situations by producing a large eschar by means of Potassa fusa over the inside of each articulation. The superfluous skin was thus removed; and as the eschar was deep, the subsequent shrinking of the cicatrix in the integuments and areolar tissue assisted to maintain the articulations in their natural positions.

"It is unnecessary to add, that this treatment by eschar was solely suggested by the severity of the case, and the necessity of extraordinary measures after adult period of life was attained. It is not recommended for imitation in ordinary Genu valgum."—*Extract from Author's Case-book.*

* See remarks on Tenotomy in following lecture.

LECTURE XIII.

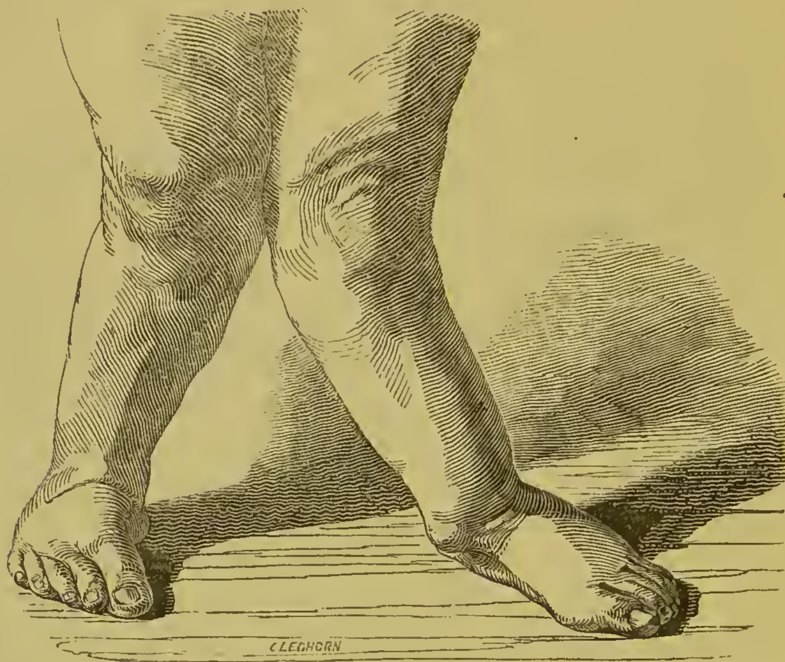
Rachitic distortions continued—Additional remarks on treatment of Genu valgum—Value of tenotomy in Genu valgum considered; use of artificial contraction as a means of perfecting a cure—Rachitic curvatures; mode of production, influence of muscular action—Rachitic deformity of foot; rachitic valgus—Treatment of curvatures of lower extremity—Flat-foot, or spurious valgus—Treatment.

The former lecture contained some general remarks on rachitis, and the special consideration of *Genu valgum*, or in-knee. If the description of this deformity be borne in mind, the reasons for considering the changes of form resulting from rachitis as a separate order of non-congenital deformities will be comprehended. The contractions arising primarily from diseases and injuries of articulations were included under the head of *ankylosis;* the distortions dependent on primary disturbance of the muscular system constituted *contractures;* whilst those which at present engage our attention arise from causes which simultaneously affect the parts composing the articulations and the muscular structures which move them.

The model (fig. 85) which I selected at the last lecture for the illustration of Genu valgum represents the deformity at an advanced stage. It exhibits the *constant* state of the individual from whose limbs it was taken,—recumbent or standing, the deviation of the limb from the natural form remained the same,—temporary pressure effected no amendment in position. But in order that the affection in the less severe form may as readily be recognised, I shall direct attention to this series of models from young children, whose ages varied from twenty months to three or four years (fig. 89 represents one of the series in question). In this instance, for example (fig. 89), the child was unable completely to walk alone; when recumbent no deformity was apparent to the casual observer; but

when placed on the feet, or when endeavouring to walk, the legs became everted. You observe the knees are not

Fig. 89.



Rachitic distortion, or " deformity from weakness," in young child: Genua valga.

the only articulations affected; the ankles suffer, the toes of one foot being everted, those of the other inclined inwardly. Such a case may be rapidly remedied by the simplest mechanical support, or by interdicting exercise: the other case (fig. 85) will, especially in adolescents, require tenotomy, or the recovery be much facilitated by it. Notwithstanding the mention of the aid derivable from tenotomy, do not too hastily have recourse to operation. I have frequently succeeded in the restoration of adults by the mechanical means in daily use in this institution. The question whether, in a given case, tenotomy shall be employed, becomes one of duration of treatment.*

* For some years past the author has wholly discontinued the use of operation in Genu valgum, having ascertained by comparison of the time occupied in treatment with and without operation, that, although with the

After complete straightening of severe Genu valgum, a superabundance of tissues on the internal side of the knee may exist. The skin and subjacent structures appear loose, and favour the tendency to relapse. This disproportion does not long continue in children, as from the growth of the limbs the natural relation becomes established. But in adolescents and adults who have respectively nearly or wholly completed their growth, its removal is more slow and uncertain; hence a longer continuance of weakness.*

Rachitism and cretinism are sometimes associated, but they are by no means necessarily combined. On the contrary, rachitis is often accompanied with precocity of intellect; but when the brain especially suffers from rachitis, the similarity with cretinism is very great [if they are not pathologically identical].

Rickety distortions of the bones are very common. Rachitis first displays itself by enlargement of the epiphyses of the long bones, the inferior extremities of the radius and ulna being peculiarly predisposed to suffer in this manner. When the disease is more severe, curvatures ensue. The long bones present indications of curvature in the following order: the ribs, tibia and fibula, femur, radius

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operation a rapid improvement is at first visible, the ultimate result is the same whether or no the operation be performed. In no other than adults did the operation ever appear justifiable. The length of time requisite for obtainment of adjustment of articular surfaces of the femur and tibia in severe adult cases, renders the gain in the first instance by operation of little moment. The author has found the inversion yield in the severest cases within three months to improved mechanical treatment, consisting either of wooden splints, hinged at outside of knee, and straightened by a ratchet or male and female screw, or with a strong common stiff iron attached to a shoe, properly adapted, and duly removed for friction and manipulations (p. 26). At present the author does not even find it necessary to confine such severe cases to the recumbent position during the daytime. He has treated, with the aid of irons, many adolescents who have followed sedentary occupations during the whole period they were under observation. Habitual voluntary flexion of the knee should not in these cases be permitted until many months after the inversion has been overcome.

* See case, note, p. 216.

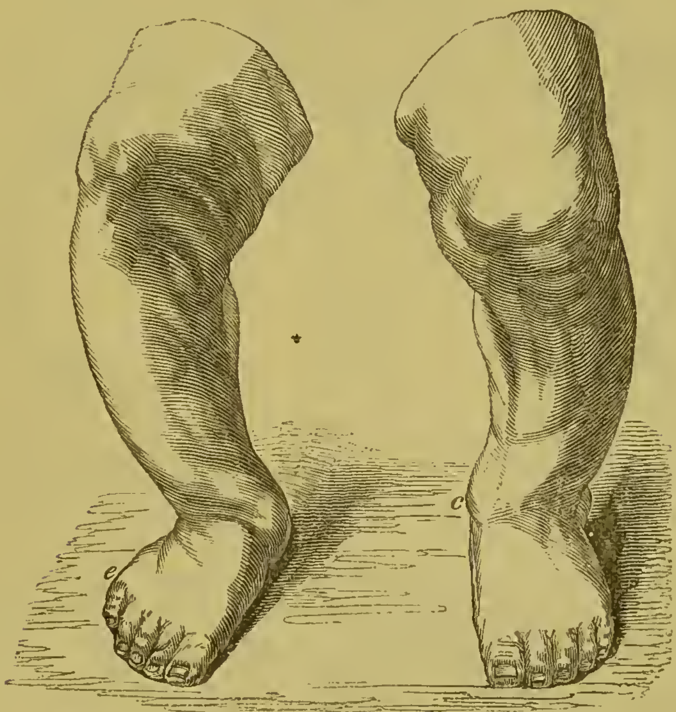
and ulna, humerus and clavicle. Being softer than natural, they yield to the action of the muscles inserted into them. This is particularly evident in the frequency of change of form of the ribs. The natural office of these bones is to maintain the capacity of the thorax. When their elasticity and firmness is destroyed, the thorax is compressed between the antagonist inspiratory and expiratory muscles, and flattening with diminution of capacity results. The ribs, notwithstanding that they have no superincumbent weight to support, yield as early, and often earlier, than any other long bones. The ulna and radius support no superincumbent weight, yet they are liable to curvature, and frequently suffer to a considerable extent.

If, in the case of the radius and ulna, we cannot admit the influence of superincumbent weight in inducing curvature, we are compelled to search for another cause. If we assume this cause to consist of muscular action, it should follow that as these bones are covered with muscles on their anterior and posterior surfaces, the bones will yield in the direction of the stronger set of muscles. The anterior muscles of the fore-arm, the flexors and pronators, constitute the more powerful mass, hence they tend to approximate the upper and lower extremities of the ulna and radius, causing an anterior concavity and a posterior convexity of these bones. I have never witnessed an anterior convexity of them. In the lower extremities the influence of superincumbent weight cannot be rejected; but if curvatures in this situation wholly depended on this cause, no pathological explanation seems probable why curvatures should not readily occur in every direction.* Observation, however, shews that curvatures of the femur, tibia,

* Delpech, who stands pre-eminent amongst the French as a scientific cultivator of orthopædy, had rightly appreciated the influence of muscular action in production of rachitic curvatures. "Il faut examiner avec attention le squelette d'un rachitique, pour concevoir comment les inflexions les plus bizarres en apparence, et qui cependant sont symétriques des deux côtés, sont produites par l'action musculaire." *Observations cliniques de Delpech et Trinquier*, p. 236, Paris, 1833.

and fibula, occur forwardly and outwardly (as in these models, fig. 90), sometimes principally forwards. This is

Fig. 90.



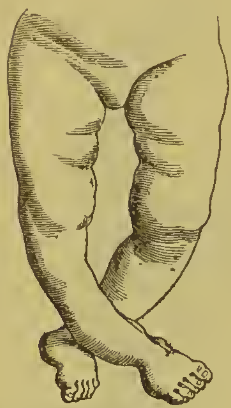
Rachitic curvature of the leg-bones, with rachitic T. valgus.

explicable by the fact, that the more powerful mass of the muscles is situated on the posterior and internal aspects of the members. The origin of curvatures from muscular action affords a solution of the occurrence of curvatures in children who have never been placed on the feet, or who have never attempted to walk.

The next feature of rachitic curvatures to which I shall advert is that which accords with the law I have, early in these lectures, laid down, that wherever the origin and insertion of a muscle remain, for a period of weeks or months, approximated, [proportionate] structural shortening of its fibres will ensue. The muscles, therefore, on the concave side of the member become contracted, and constitute a principal obstacle to restoration of the form

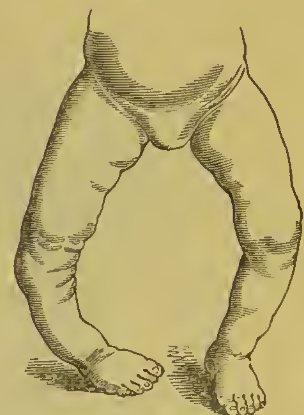
of the limb. You will observe in these curvatures (see fig. 90), that the articulation of the ankle suffers from the

Fig. 91.



*Rachitic curvatures in a young infant before walking was attempted.**

Fig. 92.



Rachitic curvatures in a child commenced before walking was attempted, much aggravated in right foot by locomotion.

altered direction of the shaft of the tibia, the internal malleolus *c* being prominent, the toes become everted *e*, an undue strain of the ligaments and muscles of the sole takes place, and a flat-foot, or rachitic valgus, is produced,—this ankle-deformity, if not remedied, becoming, in later life, often the chief impediment to ease and comfort in walking.

Treatment of Curvatures.—The available means for promoting improvement of the form of the thorax have been already mentioned, and it is unnecessary to dwell on curvatures of the upper extremity.†

* A very unsightly gait is induced by external curvature of thigh and leg bones; for whilst the weight of the body is being thrown from one limb to the other, the trunk necessarily inclines greatly to the limb which is in the act of being raised, progression taking place by a continued lateral balancing, soon followed by fatigue. Jalade-Lafond, *Recherches pratiques sur les principales Difformités*, deuxième partie, p. 279. Paris, 1829.

† Rachitic curvatures of these parts are often mistaken by suspicious parents for neglected fractures. They sometimes doubtless have been aggravated by accidental injuries, as by rough handling of a hasty nurse.

Hippocrates (Mochlicus) alludes to "distortions when the bones are crooked." Sydenham Soc. edit. p. 680.

The treatment of curvatures of the lower extremity may therefore engage our attention. It is, in the first place, essential to determine the possibility of a rachitic bone becoming straight under any circumstances. This is proved by observation of the spontaneous restoration which occurs in slight cases. An additional proof is afforded by the straightening of more severe cases by art. In slight cases you may adopt the general principles of treatment of rickets described in the last lecture, and safely leave the curvature to the spontaneous efforts of nature. Do not, however, trust her too implicitly. When with advancing age the deformity increases, the propriety of resorting to mechanical support should be considered. Common straight splints, bandaged on the concave side of the member, or irons *properly adapted* by the instrument-maker, should be employed for this purpose. I repeat the expression 'properly adapted;' for if the person you employ manufactures "irons" without reference to the individual case, the straightening may not be accomplished, and your prescription be pronounced useless, if not injudicious. Cases frequently present themselves in which the question will arise, whether the period for effecting straightening has not already elapsed. You will judge, from the general condition of the individual, whether the necessary deposit of calcareous matters, and consequent normal firmness of the bones, or even *eburnation*, have taken place, and whether the ligaments

Duval (*Aperçu sur les principales Difformités,* Paris, 1833) remarks that Genu valgum arises through weakness, and the desire of increasing the basis of support.

Genu valgum is a very common deformity, whilst outward curvature of the knee is comparatively unfrequent. Genu valgum may be regarded as an exaggeration of the normal state, for the femur naturally presents obliquely inwards, causing the habitual projection of the internal condyle, and the ordinary prominence of the inside of the knee. See statistics for eight years of Royal Orthopædic Hospital, at p. 10. Of 7533 patients, 1843 were affected with Genu valgum. Messrs. Chance and Stevens, of the City Orthopædic Hospital, in their annual report for 1852, amongst 799 patients, announce 247 "knock-knees."

and muscles have acquired their natural strength.* You may form some opinion on this subject by manipulation of the members, by ascertaining whether the bones continue elastic, or whether they feel quite inflexible. In this examination avoid much pressure, or you may find the bones yield to an unexpected extent. In short, they may bend to an acute angle, or a fissure or fracture ensue.

Is tenotomy available in rachitic curvatures? If the existence of structural shortening of muscles on the concave side of the member, and that this muscular contraction is a principal obstacle to restoration when the bones are still soft, be admitted, tenotomy becomes in principle applicable to such cases. You would expect by tenotomy to facilitate the mechanical treatment.

The following is the result of my experience of tenotomy applied to rachitic curvatures. In one case in which the tibia and fibula appeared firm, the rachitism having subsided, and *eburnation* imminent, if not present, I divided the gastrocnemii, with the view of facilitating replacement by appropriate apparatus. The result was unfavourable, inasmuch as at the expiration of six months, although the patient walked and ran freely, the bones were not straighter than before the operation. In another case, a female, aged 21, who had suffered from repeated fractures of the long bones during a period of several years, the cause of the fractures having probably been "fragilitas ossium," a disease described under a variety of names, and the precise

* The state of the teeth frequently affords indications of the direction in which rachitis tends. When the disease is severe, they are notoriously deficient in enamel, and even the bony part of the teeth may be so impaired that they are prematurely shed. It is certain that the bones in general have recovered the normal hardness, or have reached the state of eburnation, when the portion of the teeth nearest to the gum is invested with enamel, whilst the remaining part is discoloured and deficient in this important constituent. It not unfrequently happens that the alternating phases of rachitis, the fluctuations in intensity that have occurred in its progress, are denoted by parallel horizontal ridges of enamel separated by dark-coloured lines of dental matter uncovered, or only partially covered, with this substance.

pathological character of which is not determined, tenotomy was beneficial. This patient, on her admission to the Royal Orthopædic Institution, presented several (rachitic ?) deformities.* That which especially related to our present subject was extreme curvature of the tibia and fibula (fig. 93). The bones of one leg were bent to an angle of 70° or 80°. Although they felt rigid on manipulation, they were not entirely devoid of elasticity. The effect of this considerable angular curvature was that of shortening the limb five inches. The general health had during the preceding two years greatly improved, and no fracture had during that time occurred. It was probable that perfect ossification of the bones was imminent. This consideration induced me to test the advantages of tenotomy.

Fig. 93.

Curvatures of all the long bones of the lower extremities. The deformity of right limb was the consequence of frequent fractures of femur and leg bones. Drawn in 1842 from model at Royal Orthopædic Hospital.

* The diseased state—mollities ossium, osteo-malacia, rachitismus adultorum et senilis—is said by Rokitansky (Opus infra cit. p. 177) to occur principally in the trunk, and to be associated with cancer. Rachitic bones, or the softened bones of young children, although liable to bend upon the application of a small amount of force, are not liable to break by muscular action, as upon turning in bed, as was the case with the subject of fig. 93, or in the case narrated p. 228. What were then the cases, fig. 93 and that at p. 228 ? If the restriction as regards age and the part affected laid down by Rokitansky be adopted, these cases were not osteo-malacia, but ordinary rachitis. They cannot, however, be considered cases of rachitic softening, as advanced rachitic disease is not confined to a particular part of the frame, as it was in these cases to the lower extremities.

The tendo-Achillis was accordingly divided; and after cicatrisation extension was applied. The apparatus employed consisted of a shoe-piece to embrace the foot, and another piece to encircle the upper part of the femur, and touch the pelvis as a fixed point. Extension between the foot and hip was effected by a connecting male and female screw, and the deformity slowly reduced. The bones (femur, tibia, and fibula) were elongated so as to permit the approximation of the foot within two inches and a half from the ground. The interest of this case consists in the proof it affords of the possibility of reduction of extreme curvatures by the aid of tenotomy.

The applicability of tenotomy in ordinary rachitic curvatures is a perfectly different consideration. It is unnecessary in the great majority of cases, because they can be successfully treated without its assistance; and in those rachitic curvatures which resist mechanical apparatus, the issue of the operation is so uncertain that its performance does not appear justifiable. This active remedial measure is the less indicated in rachitic curvatures, for even when considerable—as they usually produce shortening of both limbs—they do not produce lameness.

[The author has under his observation a young gentleman, aged twelve, both of whose lower extremities were curved, as in right limb, fig. 93. He seldom passes three months without some fresh fracture in some part of the frame. The constitutional malady, therefore, upon which the fragility of bones depends continues. From its analogy with the case represented fig. 93, the author confides in the ultimate improvement of the constitution, and consequent deposit of additional calcareous matter in the bones. In the meanwhile the limbs have been easily straightened and guarded against fracture with common splints, without tenotomy.

Rachitic curvature is sometimes associated with other deformity, as at fig. 94 (see also case, p. 216). Occasionally

in young children curvature of leg-bones is produced by improper application of pressure in the treatment of other foot-deformities.]

Fig. 94.

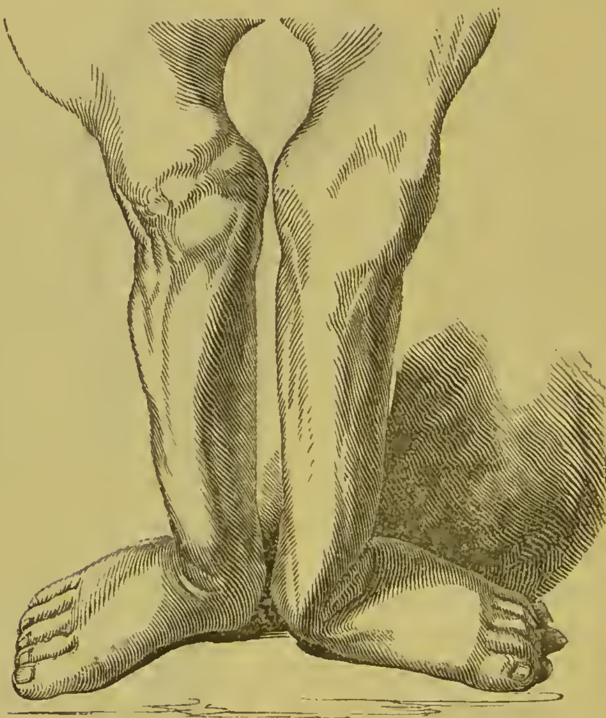
Slight rachitic curvature of leg-bones, and Genu valgum co-existing with non-congenital varus.

I have already mentioned that, in rachitis, either in consequence of curvature of the leg, or independently, the ankle-joint may be affected. The point of the foot is therefore directed inwardly or outwardly, constituting respectively rachitic varus and valgus. Rachitic inversion of the foot is less common, rachitic valgus very common. You may observe rachitic equino-varus in this model (fig. 94). It may be treated by the means applicable to Genu valgum and curvature.

In the treatment of rachitic deformities, the value of frictions with iodinous embrocations, and manipulations suited to rectification of deformity, should not be overlooked. It may be doubted whether the local application of iodine is in these cases

beneficial; but the utility of the frictions and manipulations is incontestable, and the embrocation, at all events, subserves the unquestionably useful part of the

Fig. 95.



Extreme rachitic valgus (*Talipes valgus spurius*).

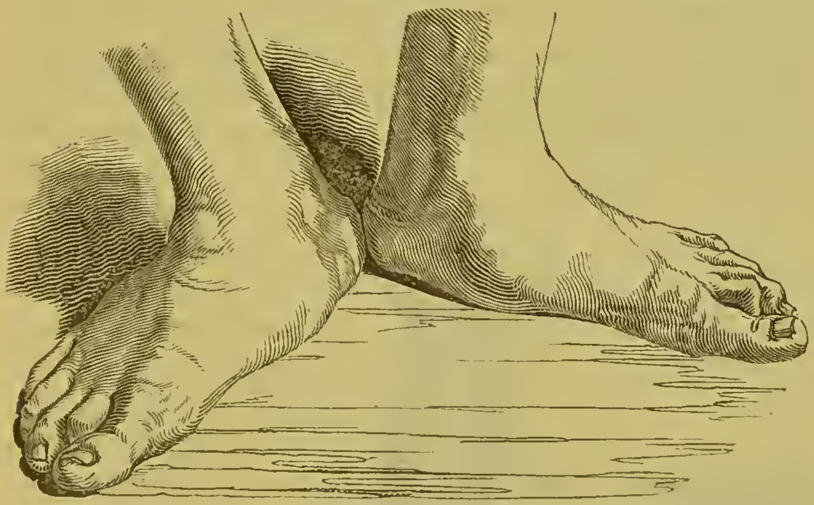
process. The diligent nurse, the experienced "rubber," of which "profession" numbers are to be found at spas and watering-places, become here invaluable adjuncts (p. 26).

The deformity of flat-foot is a common affection about the age of adolescence; you may be consulted respecting its treatment as early as childhood, but it rarely becomes a serious deformity until the age of from fourteen to eighteen years. It is not often produced later, unless from rheumatism,* and occasionally from long-continued exertion in

* Rheumatism, especially in the labouring classes, frequently lingers about the internal malleolus, probably in consequence of the greater susceptibility of this part to diseased action through excessive use. Even when no par-

standing and walking. Like the Genu valgum which occurs in growing youths, flat-foot [sometimes] appears independently of decidedly rachitic symptoms. The effects of common debility upon the limbs are so similar to those of rachitis, that pathologically I would propose to consider them as identical; but for practical purposes, and in order to simplify the remarks on the treatment, flat-foot may be considered as dependent on simple debility.

Fig. 96.



Talipes valgus spurius, or flat-foot.

On examination of one of these models (fig. 96) you remark the sinking and destruction of the tarsal arch, and consequent flattening of the sole.* In slighter cases no particular displacement of the tarsal bone can be demonstrated; the deformity then consists of a mere yielding, through elongation of the ligaments and muscles connecting the tarsal bones, the metatarsus, and the phalanges. In severer cases (as in fig. 96) the scaphoid, internal cuneiform,

ticular susceptibility exists, patients during recovery from general rheumatism experience pain at this part through the strain maintained upon weakened structures by the superincumbent weight of the body.

* See R. Adams in *Dublin Journal*, 1840.

and astragalus, leave their respective positions; the first two become applied to the ground, and the astragalus unnaturally projects. The convexity of the dorsum is lost; eversion of the toes and actual elongation of the foot ensues. The mobility of the ankle-joint may persist during months and years; but with increasing deformity it is annihilated, proper extension and flexion being rendered impossible. The equilibrium of the muscles of the ankle-joint is destroyed, the peronei and anterior muscles of the foot obtain the preponderance, and the eversion of the foot becomes ultimately as considerable as in true Talipes valgus. The preponderating muscles undergo structural shortening, the outer margin of the foot (and even sometimes the front of the foot generally) is raised from the ground, locomotion being effected to a considerable extent on the heel. The gastrocnemii then waste, and the gait becomes very unsightly.* In the origin of flat-foot weakness only is the subject of complaint; after a certain time pain at the inner ankle and in the sole is experienced, especially after long standing or walking. This pain may be so considerable as to render erexcise a cause of great suffering; but after another interval of time, provided necessity has compelled the indi-

Fig. 97.

Extreme Talipes valgus spurius, or flat-foot, seen from outer side.

* This will remind the reader of the effect of walking, in distorting the heel in calcaneus and calcaneo-valgus (p. 158), to which the rachitic deformity spurious valgus, although so dissimilar in origin, approximates in form.

vidual to continue laborious exercise, the tissues of the sole yield sufficiently to obliterate the arch, and the painful tension and consequent pain subside. Exercise in cases of extreme flat-foot, although accompanied with lameness, is not so painful as in slighter cases.*

It may facilitate a proper understanding of the rational treatment of this distortion, if it be considered in three stages. In the earliest stage you have principally to contend against undue laxity of the tissues about the inner ankle; the arch sinks owing to loss of tone in those structures which should maintain the concavity of the sole. The deltoid ligament, the ligaments connecting the inferior surfaces of the tarsal bones, especially the calcaneo-scaphoideum, the muscles, the tendons of which pass by the internal malleolus into the sole, are evidently weakened. When the foot is raised from the ground, especially after a few days' rest, it may present nothing abnormal; but when the child stands, the inner ankle projects, and the toes incline outwardly. This is the stage of the affection commonly known by the name of "weak ankle," "in-ankle." You should not conclude that the remaining textures of the limb are perfectly strong; for you will remember that in rachitis, and in general debility, every part of the member in some degree suffers. The tissues about the inner ankle, and in the sole, suffer in a greater degree, because their office being to support the superincumbent weight of the body, to which they are inadequate, they yield, and become elongated.

In the second stage the displacement is not transient during the erect posture only,—for example, as in the first stage,—but is permanent; *deformity* is present, the foot cannot be adducted, the mobility of the ankle is impaired, the yielding of the tissues of the sole is accompanied with

* The author has been consulted in several cases of spurious valgus attended with pain at inner ankle, which had been mistaken for, and actively treated for, inflammation of ligaments of ankle and sole. Complete inflammation, *i. e.* with effusion of serum, lymph, or pus, never occurs in such cases.

pain, habitual eversion of the toes, and organic shortening of the peronei and of the extensor longus digitorum.

The third stage is characterised by aggravation of the above symptoms, considerable elevation of the outer margin and front of foot, immobility of ankle, perfect flatness of sole, sinking of dorsum, great augmentation of length of inner edge of the foot, approximation of outer side of os calcis to inferior malleolus, shortening of anterior tibial muscle, proportionate relaxation of gastrocnemii.

In the first stage, the individual touches the ground with the natural tripod of the foot (the heel, the ball of the great toe, and that of the little toe), and with an undue proportion of the sole. In the second stage, locomotion is effected on the heel and internal margin of the foot and great toe. In the third stage, the patient walks almost exclusively on the heel.

Treatment of the first stage. The general treatment available in rachitis or in debility will in this stage be essential to the success of treatment specially applied to the foot. This should consist in restricting the patient in the amount of daily exercise;* in preventing the child from disproportionately resting on one limb, if one only be affected, or in prohibiting him from standing to the usual extent at lessons and amusements. Boots appropriately strengthened at the sides by the shoemaker, or raised on the inner edge, sometimes furnished with a piece of cork adapted to the natural form of the concavity of the sole, should be recommended. Embrocations or manipulations directed to the inversion of the foot, and prevention of shortening of muscles on the outside and front of the ankle, may be advantageously employed.

In the second stage, an iron or spring, to support the ankle and invert the foot, may, in addition, be employed. The question of applicability of tenotomy, which is absolutely necessary in the third stage, may even in the second

* "Pueruli sedentes ludant." Mayow, Opus infra cit.

stage be considered. The object of section of tendons is to remove the organic or structural shortening of muscles which is consequent on the altered form and relation of the ankle-joint. In the second stage subcutaneous section of the peroneus longus and brevis may be advisable; whilst in the third stage section of the whole of the peronei, extensor longus digitorum, extensor proprius pollicis, and tibialis anticus, will be required to restore the form, mobility, and function of the ankle.*

After the operation the same principles should be adopted as in after-treatment of club-foot. The apparatus which I recommend is that used in treatment of club-foot. (See treatment of Club-foot.) In its application the several parts must, of course, be reversed to effect a contrary action to that required in club-foot, as in flat-foot depression of the toes and inversion are required. No deformity of the foot is so liable to recur; mechanical support is therefore indispensable for a period of two or three years after restoration, or until growth is completed. I need strongly to insist on this circumstance, and add, that your ingenuity may often be tested in adaptation of the necessary support.

[The general health is sometimes so much impaired in cases of flat-foot in growing girls and boys from the age of ten to fifteen, and the signs of impaired nutrition from imperfect assimilations so evident, that the author has sometimes derived much benefit from prescribing entire disuse of walking for a month or six weeks, carriage or horse exercise being alone permitted. Under this treatment, with ample repose of body, good diet, and freedom of the mind from anxious studies, a great improvement in bodily strength takes place,—the ankle-joints recover power, the bones and ligaments grow into proper proportions, and the deformity is quickly cured.

* Greater attention to mechanical treatment obviates the necessity of these operations, *except in neglected cases in the third stage.*

Curvatures of bones occasionally depend upon other causes than rachitis, and are liable to be mistaken for this disease. Thus a well-marked case of curvature of bones of the fore-arm, induced by spastic action with structural *shortening* of the flexors and pronators, presented itself to the author at the Royal Orthopædic Institution in 1840 (Out-patient Register, No. 239). This case, though rare, shews that the bones of a young child which would have been capable of resisting the natural muscular action, may yield to the abnormally increased tension exercised by spastically contracted muscles. Such a case illustrates Mayow's*

* Mayow *Tractatus duo seorsum editi, quorum prior agit de Respiratione, alter de Rachitide*, Oxon. 1668; and *Tractatus quinque, quorum ultimus de Rachitide*, ib. 1674.

Glisson's elaborate works on rachitis and the resulting deformities are monuments of industrious and extensive observation. They are clearly the groundwork of many treatises on this disease which have been published during the last two centuries. (*A Treatise on the Rickets, being a disease common to Children*, published in Latin by Francis Glisson, translated by Nich. Culpepper, Gent., 1651. *Tractatus de Rachitide sive morbo puerili*, Francisci Glissonii, Londini, 1660, editio secunda.) These two works of Glisson are contained in the admirable library of the Royal College of Surgeons. The author has been unable to ascertain whether other editions of Glisson's works, or a still earlier treatise on rickets by Whistler, are contained in the Library of the Royal College of Physicians; for, on inquiry at that institution, he was informed that its library is not open to Licentiates of the College.

Glisson gives an ingenious explanation, with diagrams, of the manner in which curvatures of the *long* bones and of the spine, which he compares with a *long* bone, take place. He believed that unequal deposit of bony matter, and consequent unequal growth of the two sides of a bone, occasioned the curvature. Mayow confutes Glisson's theory, and approaches more nearly to the explanation which the author believes to be the correct one. Mayow says, "liceat *hypothesin* hanc *nostram* exemplo illustrare, si arbori teneræ et crescenti chorda superius et inferius alligetur, ita tamen ut non tendatur; nullus dubito, quin arbor dicta crescendo incurvabitur." Mayow, however, assumes that the muscles on the concave side of a bone do not properly grow, instead of regarding the bone to be primarily deficient in firmness, and consequently acted upon by the contractile muscle. Probably both Glisson and Mayow derived their anatomical observations of rachitic bones from those of individuals who had died after eburnation had taken place.

J. L. Petit (*Maladies des Os*, 1741, t. ii. p. 545) has the most complete arrangement of the consecutive causes of curvatures: 1st, the softness of the

theory of the production of rachitic curvatures. He believed that the curvatures result from insufficient growth of the muscles, which, by remaining too short, bend the bones, as a bow is bent by the string.

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bones; 2d, their natural curves (for rachitic bones bend in the direction of these curves); 3d, contraction of the muscles; 4th, the weight of the trunk.

Portal (*Observations sur la Nature et le Traitement du Rachitisme, ou des Courbures de la Colonne vertébrale, etc.* Paris, 1797) describes the changes which the bones undergo in this disease. He points out the general diminution in their length and diameter in rachitic subjects, after the growth of the frame is completed, the tumefaction and increased vascularity of particular bones during the active stage, due to effusion of watery, sanguinolent, or lymph-like materials into the cancellous structure. In other cases he found the cells filled with cartilaginous substance. He sometimes found rachitic bones indurated and hypertrophied. He also describes the coexistence of hypertrophy of brain-tissue, sometimes with softening, at other times with induration of it. The muscles rarely present their natural colour and consistency, being whiter than common, sometimes resembling fat; and occasionally the fibres are contorted, shortened, and horny (adipose and fibrous transformations), as Glisson and Mayow had already shewn.

Stanley (*Med.-Chir. Trans.* vol. vii.) shews that the greatest amount of secondary induration occurs where the curve is most considerable.

Duval (*Aperçu sur les principales Difformités*, Paris, 1833) regards the changes in rachitic bones to be due to *inflammation* of the periosteum.

Guerin (*Mem. sur les Caractères généraux du Rachitisme*, 1839) divides the alterations of the bones into three stages: 1. sanguinolent infiltration into and between all the tissues of the bone: 2. gelatinous matter taking the place of the sanguinolent; 3. subsequent induration of the bone—eburnation.

Rokitansky (Syden. edit. 1850, vol. iii. p. 174) describes two forms of rachitis, the gelatinous and cartilaginous: he confirms the views the author has expressed of the dissimilarity of rachitis and tuberculosis, or scrofula, and of the conjoint affection of the muscles.

Excepting the opinion of Duval, who regards rachitic affection of bones to be due to periostitis, the author finds amongst special writers on rachitis no investigation of the nature of the dynamic process by which the physical changes are induced. Taking into consideration the acknowledged predisposing and exciting causes, the rachitic cachexia presents this analogy with the strumous and the scorbutic cachexiæ, that in consequence of the action of the predisposing and exciting causes, the blood is altered and impoverished; hence an abnormal process of nutrition is established in those parts of which at the time the development and growth are most active; these being in rachitis, the osseous system and its appendages, and the central organ of nervous system. It is the character of these abnormal pro-

Flattening and distortion of the ribs, with projection of sternum, are sometimes produced in young children independently of general signs of rachitis, and without local indications of that disease in other parts, through impeded *development* of the lungs (during the growing period of life). Thus the author watched in consultation with Mr. Mimpress, a child, æt. 5, who presented no general or local sign of rachitis, but who after a chain of infantile dangers—pertussis, broncho-pneumonia, convulsions, and laryngismus stridulus—became rapidly affected with prominence of sternum, and flattened cartilages of ribs and sides of chest. It is unnecessary to describe in this place the ordinary shrinking and deformity of chest resulting both in children and adults after recovery from chronic pleurisy or empyema (see Lecture on Spinal Curvature).

Amongst older writers many interesting notices of severe rachitis occur. In the work of Ishmael Abulfeda, biographer of Mahomet, mention is made of one Gattib, a noted fortune-teller, who had no bones. "Hominis sine ossibus exemplum habemus illustre." The bones of this individual were, at all events, so flexible, that he could be rolled up from the feet to the collar-bones like a cloak: "complicari poterat instar vestis." Houlier, a noted physician of the Faculty of Paris, relates: "Cuidam mulieri Lutetiæ totum corpus molle et sine ossibus fuit."* (Portal, Opus cit.)]

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cesses of nutrition not to proceed imperceptibly or in a latent manner, but to be accompanied with more or less of hyperæmia, giving rise to some of the physical evidences of their existence. It is not a mere passive cessation of deposit or absorption of suitable materials (in rachitis the earthy substances); but in rachitis, struma, and scorbutus, in each of which states the bones are apt to be affected during their developmental period (in scorbutus during reproduction after fracture also), the process is accompanied with an active vascular reaction allied to inflammation, itself regarded as another process of abnormal nutrition.

* Actæ Soc. Nat. Curios.

LECTURE XIV.

Pathology of congenital distortions—Congenital distortions represented by acquired deformities—Associated muscles conjointly affected—Analogy with strabismus and stammering—Congenital club-foot—Influence of maternal imagination—How affected—Influence of malposition in utero.

Congenital Distortions.

The observations on the pathology of distortions in general will have prepared you for the study of congenital deformities. You will remember that the reason formerly assigned by me for commencing with the study of distortions arising after birth was, that greater facilities are presented for examining their production and mode of development; that in comprehending that which daily occurs under our observation, we are enabled to apply the information thus acquired to unfolding the apparent intricacy of that which takes place in the recesses of the uterus. One of the most striking facts elicited from comparison of non-congenital with congenital deformities is, that certain deformities which are slowly acquired in extra-uterine existence, in consequence of paralysis, or suddenly through spastic action of muscles, are faithfully represented in certain deformities which originate during intra-uterine life. This fact is no sooner seized than the mind of the observer is at once led to the inference, that the causes which have produced these identical phenomena, must have been identical. The pathologist then more closely investigates the subject, compares anew the apparently identical changes of form which the parts of the human frame have undergone; what the identical causes are that have produced identical results;

and lastly, he compares the causes which he knows operate after birth in the production of deformity, and determines whether these causes can be those which operate in utero.

The class of non-congenital deformities which so greatly resemble the congenital affections are the contractures; and you will remember that paralysis and spasm, and other causes enumerated in the lectures on contractures, are the precursory phenomena of these alterations from the normal form. In short, the causes of permanent deviations from the natural form in these cases operate by destruction of equilibrium in the power of opposing sets of muscles. It is unnecessary again to occupy more time with the manner in which paralysis and spasm produce deformity, it is sufficient to bear in mind, that when the equilibrium of opposing sets of muscles is destroyed, those that preponderate ultimately become organically or structurally shorter,* permanently adapted to the altered relation of the parts contracted, whilst the overpowered muscles, being permanently elongated, are further weakened in their texture; and even when the original cause of destruction of equilibrium is removed, the parts do not spontaneously return to a natural form.

The doctrine of identity of cause in the production of non-congenital and congenital deformities presupposes the admission that similar diseased or fortuitous conditions may occur previously as well as after birth. This doctrine can,

* Langenbeck's experience throws doubts upon the reality of this structural shortening; since, during the state of anæsthesia, muscles which have been for many years contracted may be entirely elongated. (*Commentatio de Contractura et Ancylosi Genu nova methodo violentæ extensionis ope sanandis.* Berolini, 1850. See pp. 41, 60 of these Lectures.)

Langenbeck states permanently elongated; but the author, on the contrary, has found that when the state of anæsthesia has passed away, the shortened muscles again contract, though their subsequent elongation is facilitated. It appears to the author that the anæsthetic agent removes for a time volition and the organic contractility of the fibres, in consequence of which the mere physical structural shortening of the fibres is easily overcome; and this physical shortening once overcome, the subsequent contraction is rendered less resisting.

in the present day, be scarcely disputed; too many instances of disease (beyond the domain of the pathology of deformities), present at the moment of birth, or of which the traces are evident at birth, daily occur, to leave doubt in the minds of rational pathologists. I need mention only variola and tuberculous disease. The causes of *contractures*, you may recall to mind, are spasm or increased energy of certain parts of the muscular system, paralysis or diminution and deprivation of energy, and accidental causes, which, by inducing temporary malposition of a limb, occasion a contraction of some muscles, relaxation of others, and deformity. We will now consider some of the facts on which rests the presumption that these causes may affect the fœtus in utero as well as the individual at a later period of existance. It is a fact that children are often born with this deformity (see fig. 98), the most common of congenital dis-

Fig. 98.

Congenital infantile talipes varus.

tortions, termed Talipes varus, and when presenting the average degree of severity, the contraction of certain muscles on the posterior and internal surfaces of the limb resists the best-contrived mechanical modes of treatment, and, though partially overcome, continues throughout life. Experience demonstrates that this stubborn resistance to mechanical extension is, in non-congenital cases, only offered by structural shortening combined with augmented energy of the muscular fibre; and the practitioner is led to infer a similar condition of muscles in congenital Talipes varus. Again, cases of congenital deformity occur, though but rarely, in which a paralytic condition of certain muscles unquestionably exists.

It is, then, an indisputable fact that certain deformities present themselves at birth, in which certain sets of muscles, usually the same class of muscles most obnoxious in after life to spastic contraction, namely, the flexors and adductors, are found actively contracted; and when, in addition, we observe numerous deformities in the same individual, as, for example, contracted knees, contracted hips, club-hand, in all of which the flexors and adductors, or their analogues, are the muscles specially contracted, we are led to assume that a common cause has affected these different parts of the frame.* We cannot conceive that an accidental

* A review of the opinions of some earlier writers on the causes of congenital distortions may facilitate the study of the subject. Talipes varus, or congenital club-foot, is the most common of congenital distortions, and has elicited most attention. The views entertained of this affection may serve as a type of the opinions formed of distortions in general.

Duverney asserted that the *monstrosity* depends on the unequal contraction of the flexors and extensors, the weaker† muscles being drawn by the stronger and more contracted in an opposite direction; whilst the unfortunate patients instinctively favour the increase of the deformity by turning the feet in the direction of the action of these muscles.

Boyer‡ admitted the inequality of power of the abductor and adductor

† Traité des Maladies des Os, tome ii. chap. 3.
‡ Leçons du citoyen Boyer, rédigées par A. Richerand: Paris, 1803, tome ii. p. 247.

or mechanical cause, acting from without upon the fœtus, could act on so many articulations in an invariable manner. A satisfactory explanation of the concurrent affection of

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muscles to be the origin of varus and valgus, but believed that congenital varus might be produced by an improper position of the fœtus in the uterus. He attributed the occurrence of varus after birth to the nurse having permitted the infant to place the limbs in irregular positions; and as the bones are at this period cartilaginous, and can be compressed into any form, he recommended that the cure of the distortion should be undertaken immediately on being perceived. He was also of opinion that if the process of ossification be completed during the continuance of the deformity, the bones will for ever retain their form, and tbe distortion of the limb remain irremediable.

Scarpa thought tbat Duverney had mistaken the effect for the cause, and stated that proof might be adduced of the primary origin of the disturbance in the osseous system, through which the insertion of some of the muscles became approximated to their origin, and that of others removed from it; the former becoming shortened, the latter elongated, in the same manner as distortion occurs in fractures and dislocations. He, however, concedes, that in infants, after the occurrence of distortions of the bones, the disturbance of the equilibrium in the power of the muscles greatly contributes to maintain the deformity. (Opus infra cit.)

Jörg,* on the contrary, distinctly states that the action of the muscles is the proximate cause, and naively regrets that Scarpa omitted to publish the proofs of the primary occurrence of distortion of the bones. Jörg was led to this opinion by witnessing the occurrence of non-congenital varus from an apoplectic seizure.

Rudolphi† gave a more complete view of the origin of T. varus than any of his predecessors, and one more consistent both with physiology and pathology. He concluded that congenital Talipes, and the analogous deformity of tbe hand (club-hand), arise from disordered influence of nerves on muscles in the fœtal state, by which their contraction is prematurely excited,‡ and often in so vehement a manner, that the mother experiences pain from the convulsive motions; tbe limbs thus become distorted, and permanent deformity is often thereby occasioned. He observes, that the authors who have maintained the injurious influence of external and mechanical causes, such as pressure of the uterus, through an improper position of the fœtus, appear to have been unaware that these distortions are not unfrequently witnessed in embryos of three or four months.§ Rudolphi not only points out the influence exercised

* Op. cit. p. 87. † Physiologie, 6tes Buch, p. 323. ‡ Ib. p. 319.

§ Embryos of three to five months, affected with talipes, and exhibiting malformations or deficiency of the cerebrum and medulla spinalis, are common in anatomical museums. Some are anencephalous, and others hemicephalous, both the hands and feet being affected in this manner, shewing the extensive participation of the system in the disturbance and destruction of the nervous centres.

certain classes of muscles rather than of others can only be given by reference to a cause acting within the fœtal organism. When, by this process of reasoning, the field of re-

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on the muscles of the extremities, by powerful and general causes affecting the entire nervous system of the fœtus, but remarks that Talipes often occurs after birth, in infants in other respects well-formed, from simple spasm.

Delpech,* in his first publication on the subject, adduces but few important arguments in support of the opinion adopted by him, that the deformity of club-foot arises from malformation of the tarsal bones.† He, however, appears to have been aware of the insecurity of the basis of this theory, and admitted that the success attending his curative exertions might be advanced as an argument against it; having followed that observation by inquiring how it happened that these affections were so speedily remedied, if they depended on serious malformations of the bones. He also raised the question whether—admitting that a simultaneous inclination of all the bones towards the same side favoured the opinion that the distortion arose from muscular action—a derangement of the muscles, affecting their length, might not be capable of producing a disturbance of the position of the bones, and consequent deformity of the limb. He considered the existence of a conjoint affection of all the anterior or posterior muscles of the leg, by which their development in relation to the bones might be impeded, and a shortening result, to be more *natural* than that the entire bones should become so affected as to alter their form on a regular and systematic plan, and thus produce an universal deviation of the whole of the articular surfaces in one direction. In opposition to these arguments, the importance of which he admitted, he asserted that the change in the form of the bones is observed to precede the shortening of the muscles, but, like Scarpa, adduces no proof in support of this assertion. He also states, that at birth the muscles do not contribute to the maintenance of the deformity, the foot being at that period readily reducible to the proper position.

This statement is erroneous; for although the foot can frequently be restored by pressure to its natural position, many instances occur in which a slight amendment only can be thus effected; and in all cases the resistance of the muscles is perceptible. Delpech, however, conceded with Scarpa the influence exercised by the muscles on the progress of the affection, in explanation of the increase of the deformity.‡ As Delpech, in a treatise§ published six years afterwards, renounced the opinion of the dependence of Talipes on primary disease of the bones, the relation of his earlier opinions might have been unnecessary, had they not been still entertained by other authors. He was then induced to conform to the theory, that these distortions arise from muscular action, by witnessing the occurrence of two cases of

* Chirurgie clinique de Montpellier: Paris et Montpellier, 1823.
† Ib. p. 166. ‡ Op. cit. p. 199. § De l Orthomorphie: Paris, 1829.

search is narrowed, we inquire which of the systems of the fœtus can, by its derangement, occasion the abnormal conditions of muscle on which congenital deformities depend.

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varus-like deformity, at an age when the bones had acquired complete development: one, that of a soldier whose external popliteal nerve had been injured by a gun-shot wound in the thigh, succeeded by paralysis of the peronei, tibialis anticus, extensor longus digitorum, and extensor proprius pollicis muscles (see p. 128 of these Lectures). Deformity ensued through contraction of their antagonists. The patient, on recovery from the first effects of the injury, walked on the external edge of the foot, then on the instep, and ultimately on a protuherance formed hy the anterior extremity of the os calcis, the dorsal surface of the os cuboides, and the malleolus externus* (see Contracture).

The other case was equally interesting, as it demonstrated the production of a similar deformity from an opposite cause. A woman at the age of twenty-four years hecame affected with abscesses in the thigh and necrosis of the femur; and during the progress of the disease, which continued for three years, contraction of the posterior muscles of the leg occurred, as Delpech says, either through *sympathy* or propagation of the deep-seated inflammation to the sciatic nerve, the foot being drawn hoth downwards and inwards, and distorted so as to resemble complete varus (see Ankylosis). Delpech states that he had never previously witnessed so severe a case of varus, the toes heing drawn to within three inches of the heel. Notwithstanding the abandonment of the opinion of the existence of a primitive affection of the osseous system, and the subsequent assumption that the deformity was attributable to active contraction of the muscles from affections of their nerves, followed hy structural shortening through suspended development and atrophy, he supposed that the gastrocnemii were the only muscles involved in the production of varus, the inward inclination of the foot being gradually produced by pressure exercised in the act of walking. It is doubtful whether Delpech ever witnessed the more severe gradations of T. varus, in which the child, on the first attempts to walk, inevitably treads on the instep; although he describes the presence of a slight inward tendency of the point of the foot at birth, which he endeavours to explain by stating that the posterior tuberosity of the os calcis spontaneously inclines somewhat inwardly. But even were this the case, and the hcel likewise drawn further inwardly by the contracted gastrocnemii, it would follow, in the absence of contraction of other muscles which might direct the tocs inwardly, that thcy would be directcd outwards. It will, howevcr, be shewn, that the posterior extremity of the os calcis

* The author has never seen the malleolus externus applied to the ground, notwithstanding the extent of the deformity; but the part is sometimes invested with a corn produeed by frietion against the shoe.

Disturbance and disease of the nervous system presents itself as the key to the solution of the difficulty; and we may next inquire whether other facts derived from obser-

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inclines externally towards the fibula. (See Morbid Anatomy of Club-foot.) Moreover, another cause of the inward inclination of the front part of the foot exists — contraction of the adductors.

Cruveilhier,* notwithstanding his valuable contributions to the pathology of club-foot, adopted the unsatisfactory explanation of its production by a mechanical cause. He, however, arrived at the conclusion, that club-foot is not produced by pressure exercised by the uterus on the fœtus, or by any external pressure acting on the mother; being aware of the birth of infants affected with Talipes during whose uterine existence there had been no deficiency of liquor amnii, and of that of well-formed infants wherein a paucity of liquor amnii had been observed. He was also cognisant of the fact, that pregnant women who have received blows and contusions on the abdomen, and others in whom, from the desire of concealing pregnancy, injurious pressure on the uterus had been maintained, have nevertheless given birth to children free from distortion; whilst many women, who had neither been exposed to injury nor subjected to pressure on the uterus, have been delivered of infants affected with Talipes. But, prepossessed in favour of the existence of a mechanical cause of the deformity, he became convinced that club-foot and club-hand arise from the limbs of the fœtus being arranged in improper positions in relation to each other and to the trunk of the body, by which their mutual development is impeded. In corroboration of this opinion, he affirms that the carpus being composed of small bones, and its articulation very loose (the reverse of the ginglymoid articulation of the ankle), no deformity of the hand analogous to Talipes varus could occur, as the fœtal distortion of the carpus and metacarpus disappears after birth, the removal of the pressure causing their return to the natural form and position. The inaccuracy of the statement of the spontaneous disappearance of club-hand after birth proves the fallacy of the inference. The author observed, in several fœtuses contained in the Berlin Museum affected both with club-hand and club-foot, that the hands could be reduced by pressure to their proper position; but, like club-foot, on the removal of the pressure, they relapsed into the distorted state. The author has likewise seen a youth, aged seventeen, born with these deformities of the feet and hands: the distortion of the former gradually increased through the injurious effects of exercise, the rigidity of the contraction being so great, that pressure with the hands effected no diminution of the deformity. The hands, the left being the more distorted, had remained in a position similar to that presented at birth, except that, until he commenced exercising volition, they were maintained in an extreme

* Anatomie pathologique du Corps humain: Paris, 1830, livraison ii.

vation of fœtal phenomena justify the opinion that derangement of the nervous centres occasions the distortions in question. It is remarked that fœtuses which have evidently

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state of flexion and pronation, being closely applied to the anterior and internal surface of the fore-arm. At this period the youth endeavoured, by exerting the extensor and supinator muscles of the wrist, to overcome the contraction of the flexors and pronators. Hence the hands were not at all times so fully contracted as at birth ; but on the withdrawal of the influence of volition from the extensors and supinators, these muscles yielded to the contracted flexors and pronators, and the hands assumed the original distorted position. The left was then closely applied to the anterior and internal surface of the fore-arm ; the right, being more controllable by the extensors and supinators, spontaneously occupied a less distorted position. The resistance of the flexors and pronators was distinctly perceived on attempting to place the hands in a proper position. Had Cruveilhier witnessed a case of club-hand in the living subject, he would not have asserted that this affection is spontaneously remedied after birth. Club-hand suggests many important reflections, being precisely analogous to Talipes varus. The simultaneous existence of flexion and pronation in club-hand is strictly comparable with the extension* and adduction of club-foot.†

When both extremities are affected with Talipes, the left frequently exhibits the higher grade of deformity : this was the case in the present instance. The distortion of the hands thus presented a further analogy, as the muscles of the left were less controllable by volition, occasioning a greater deformity. The superiority of the right hand might be explained by the supposition that it was more employed than the left ; but this patient was unable even to use the right in the majority of actions in which it is usually employed ; and to supply the deficiency, he generally resorted to the use of both, more particularly in the act of grasping or lifting. This explanation is inapplicable to the left foot; for it cannot be contended that persons affected with Talipes in each foot exercise either in preference. The existence of this analogy between Talipes and club-hand strengthens the opinion of the dependence of these distortions on abnormal muscular contractions. It might, indeed, be con-

* See note, p. 110.

† Many years since the author witnessed an adult congenital case of club-hands and club-feet. The distortion of the hands corresponded with the above description, and the analogy with club-foot was still greater; as, in addition to the affection of the flexors and pronators of the wrist, several muscles in the palm of the hand, particularly the opponens and flexor brevis pollicis, were contracted in precisely the same manner as the muscles of the great toe in Talipes. The left foot was similar to fig. 105 of these Lectures; the right resembled fig. 107. Distortion of the hand may also occur from unnatural contraction of the extensors and supinators of the wrist (see p. 148 of these Lectures). The existence of this distortion was predicted by the author from analogy in *Treatise on Club-foot, &c.*, 1839, Introduction, p. xxxix.

suffered derangement in the development of the nervous centres, such as those denominated hemicephalous or acephalous, or affected with spina bifida, very frequently pre-

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sidered a singular occurrence that a mechanical cause,—such as the limbs during fœtal existence becoming twisted into unnatural positions, and impeding their mutual development,—should invariably induce relaxation, followed by shortening of certain muscles physiologically associated, and also stretching, followed by elongation of other muscles.

But in the demonstration of the dynamic cause of club-foot, allusion to the analogy of club-hand is unnecessary: the characters of the former may be further investigated without any reference to club-hand. As in Talipes varus, the navicular, cuboid, and cuneiform bones, with the metatarsus and toes, are inwardly inclined by the agency of exterual pressure, so that the navicular bone is brought into contact with the internal malleolus, how happens it that these parts are never thrust in the opposite direction by the navicular and cuboid bones becoming forced from their connexions with the astragalus and calcaneum, and by the cuboid bone becoming placed in contact with the external malleolus? If the distortion were produced by external violence, the mechanical arrangemeut of the tarsal bones would permit the os naviculare and os cuboides to be forced outwardly as readily as inwardly. But this never occurs, as no muscles capable of drawing these bones outwardly are inserted into them. Talipes valgus is the deformity most opposed to Talipes varus; but although an affection as opposite as can be produced by the contraction of the contrary sets of muscles, yet if the distinetive character of T. varus is described as an inward twisting and rotation of the front of tbe foot, by separation of the navicular and cuboid bones from the astragalus and calcaneum, the peculiarities of Talipes valgus could not be contrasted as opposite; for in this distortion the entire foot is maintained in a certain position from muscular action, but no *outward* twisting in particular of the front of the foot takes place from separation of any of the tarsal bones. The constant recurrence of the same series of pathognomonic symptoms in Talipes contributes to prove its non-dependence upou external causes. Every disease is characterised by a peculiar mode of evolution, accompanied by the same essential symptoms. Talipes has its distinctive traits equally with peripneumonia, variola, epilepsy, or hernia; indicating that its production takes place aecording to certain internal pathological laws, and not from the operation of external agents.

Tourtual (Opus infra cit.) inclines to au opinion of Cruveilhier, that the frequent co-existence of Talipes in both limbs, and the occasional accompaniment of "monstrositics of other organs," arc proofs of its dcpcndcncc upon an unnatural shape of the astragalus. But this complication in fœtuscs affected with Talipcs tends less to prove its dependence on primary malfor-

sent club-foot, club-hand, or other deformity. The co-existence with congenital club-foot of congenital squinting, and even congenital stammering or misenunciation,—dis-

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mation of the bones than upon some powerful cause disturbing the nervous centres, and affecting the functions; and in severer Talipes impairing the development of the nerves and muscles of the distorted limb.

Philip von Walther* has attempted an ingenious hut insufficient explanation of Talipes. The untenahleness of his theory may he demonstrated hy a reference to the discoveries of others in the history of the development of the human emhryo. Were its accuracy admitted, we should return to the notion that Talipes is a monstrosity hy defect. He states: "Talipes is a natural grade of the development of the foot, and embryos of three or four months very frequently *retain* one or both feet in this state. The foot as well as the hand (and other memhers of the trunk) are formed from a hladder filled with fluid, which hursts along its internal side, the inner and outer edge of the foot resulting from the margins of the rupture, the sole being formed by the space afforded hy their expansion and separation. The future external margin of the foot is at first drawn downwards; the sole, which is still very concave, presents internally; the future internal margin is directed upwards; and the hack of the instep looks outwardly;" thus constituting a complete Talipes varus. From this it would follow, that every fœtus, at an early period of development, has two club-feet. But if Talipes varus be a state of natural embryo-development, the inquiry may be instituted as to which of its natural stages Talipes equinus and Talipes valgus are respectively referrible. By whatever further stretch of imagination this theory may he applied to the explanation of Talipes equinus, its application to Talipes valgus is decidedly inadmissihle.

His explanation of the manner in which the feet (Talipedes vari) of all embryos, during the progress of development, are converted into natural, well-formed feet, is equally ingenious. He states: "The flexors of the foot (tihiales anticus and posticus, the gastrocnemii,† and more particularly the soleus and plantaris), and the flexors of the toes, are the muscles first formed, and the action of which originally predominates. The extensors (peronei and extensors of the toes) are suhsequently formed, and oppose the first series of muscles, and ultimately keep them extended; the foot is gradually directed outwardly, the sole hecoming flattened; hut the external margin of the foot

* System der Chirurgie, Band i. p. 349: Berlin, 1833.

† P. von Walther regards the muscles on the posterior aspect of the leg as flexors, in consequence of their pathological relations. See note, p. 110. He has erred in classing the tibialis anticus with the gastrocnemii as a flexor; for although it bends the foot, it is, according to his nomenclature, an extensor. Observing its contraction in T. varus, he could not separate it from the gastrocnemii: he should therefore have denominated it adductor in relation to this distortion, from its assisting to draw the foot inwardly.

eases which clearly depend either on the increase of the involuntary or decrease of the voluntary powers of certain orbital and laryngeal muscles, corroborates these views.

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is not drawn outwardly (and upwards), in consequence of the extensors (and abductors) not having at this period acquired sufficient power. Should the foot remain in this grade of development, varus will be discovered at birth, the contracted and shortened flexors preponderating over the elongated and debilitated extensors, as they naturally do at an earlier period of uterine existence. . . . The propensity of the generality of infants to tread on the outer edge of the foot results from the circumstances attending the former stage of development—the last remains of a slight grade of T. varus."*

A more cogent argument against the theory of P. von Walther is the circumstance, that other observers of the phases in development of the embryo have not witnessed the formation of the hands and feet from a bladder, by the rupture of which, and the separation of its margins, the edges of the foot are formed in the manner described by this anatomist.†

Stromeyer‡ attributes varus to increased energy in the affected muscle, morbid contraction or motion in the muscular fibres—tonic spasm. The muscle, through constant contraction, becomes inert with reference to its particular function, but continues in a state of tension from its fibrous structure.

The inward inclination of the fore-part of the foot, which constitutes the difference between T. varus and T. equinus, has by Stromeyer been attributed to deficiency of the internal malleolus; Delpech and Cruveilhier are also of opinion that this cause greatly contributes to the maintenance of T. varus. The author has never observed, in fœtal or adult instances of dissected T. varus any material deficiency of this process. After long continuance of the tarsal bones in their improper position, and consequent compression or friction by the navicular bone, it occasionally becomes smooth at the extremity; but this cannot much affect the ankle-joint. The deficiency, when existing, should be regarded as an effect, and not as a cause (see figs. 43, 110, and 111).

* Dr. Pockels directed the author's attention, during a visit to Brunswick, to the opinion that T. varus is an unnatural increase of the propensity of children to turn the feet inwardly. This propensity depends upon the organisation of the muscles and the structure of the ankle-joint, which tend, in the absence of volition, to produce an inward inclination of the toes. During fœtal existence, and prior to the exercise of volition in infants, as well as during sleep, the limbs are under the influence of the involuntary contractile powers of the muscles. The gastrocnemii and adductor muscles, constituting the larger mass of muscular fibres, maintain in the embryo and infant the inward inclination of the toes and the elevation of the heel, although the foot is occasionally moved in every direction. To explain more fully—the child is at first disposed to tread on the external margin of the foot, because the muscles are only gradually subjected to the control of volition; but by continually striving against the involuntary contractility of the muscles, perfect use of the feet is finally acquired.

† See Valentin, Entwickelungs-Geschichte des Menschen, p. 245.

‡ Ueber Paralyse der Inspirations-Muskeln: Hannover, 1836.

In the case of strabismus and psellismus no question can be raised of the possible operation of causes independent of the fœtus, accidental pressure for example. If further

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Maisonnabe believed that T. varus depends on shortness of the plantar fascia. The opinion of the dependence of congenital distortions on shortening of fasciæ may, as Delpech observes, be refuted by the single observation, that it is insufficient to explain the occurrence of Talipes valgus.

The ligaments cannot directly influence the production of the deformity; but the restoration of the foot is impeded by their diminished length, the result of long continuance in an improper position.*

Stromeyer has stated, that if contraction of the gastrocnemii muscles occur during the later period of uterine existence—after the ankle-joint has acquired a certain degree of firmness by the development of the internal malleolus, and the ligaments of the joint having been fully formed—Talipes equinus, either with or without a slight inward inclination of the foot, is presented at birth; whereas should the muscular contraction occur at an earlier period, Talipes varus is the result.† And as the majority of cases of Talipes equinus, and the milder forms of Talipes varus, are curable by division of the tendo Achillis only, he considered the shortening of the muscles of the calf the essential cause of the whole of these distortions, the peculiarities of each being regarded as secondary phenomena. He likewise doubted the influence of the anterior tibial muscle in the production of Talipes varus, and observed that this muscle cannot draw the front part of the foot inwardly whilst the heel is elevated and the foot extended beyond a right angle with the leg;‡ and consequently that as this extension takes place in Talipes varus, the influence of the tibialis anticus must of necessity be very slight, and of secondary importance. He admitted the existence of contraction of the tibialis posticus, but considered that the situation of this muscle cannot permit any great contraction of its fibres, and entertained doubts of the utility of dividing its tendon.

Guerin (Opus infra cit.) ably advocates the dependence of varus upon derangement of nervous system of the fœtus. Duval (Op. inf. cit.) acknowledges both uterine pressure and cerebro-spinal uterine influence. An objec-

* Cruveilhier erroneously contradicts the opinion of Scarpa, that in T. varus the external ligaments of the ankle are elongated. The author has found the internal lateral or deltoid ligament shortened, and possessing considerable density. Mackeever (*Edinburgh Medical Journal*, vol. xvi. p. 220, 1820) states that in the T. varus of an infant in whom the os scaphoides with the os cuneiforme internum were drawn close to the internal malleolus, he could not abduct the foot until he had divided this ligament.

† Stromeyer, Beiträge zur operativen Orthopädik, oder Erfahrungen über die subcutane Durchschneidung verkürzter Muskeln und deren Sehnen: Hannover, 1838.

‡ The author, in his inaugural dissertation, Berlin, 1837, has expressed the same opinion; but at the period of the publication of his *Treatise on Club-foot, &c.*, 1839, was compelled to differ from his respected and experienced friend, to whom he is indebted for the great and lasting benefit of the removal of much lameness. (Equino-varus acquisitus.)

testimony be requisite to convince you that these deformities depend primarily on derangement of the nervous system, analogous, if not identical, in its nature with the derangement of the nervous system which occasions similar deformities during infancy, childhood, and adult life, you may inquire into the possibility or probability of the nervous system of the fœtus being subjected to disease, and expect me to describe the manner of its production. The most frequent sources of derangement of nervous system of the infant and child are disorders of nutrition, debility of nervous system inherited from the parents, and undue excitation of the delicate organisation of these parts. Similar sources of derangement appear to me to exist during uterine existence. I have questioned many parents who have given birth to infants thus affected, who could assign no other cause for the affliction than that of having suffered from general derangement of health during pregnancy. Several mothers have in this respect strongly contrasted the particular gestation with former pregnancies. Others have remarked the unusual extent of the intra-uterine movements of the fœtus, an almost convulsive condition. From analogy it may be inferred that no more probable cause of production of derangement of nervous system of the fœtus could occur than general derangement of the health of the mother, whether this derangement operate through the nervous system of the parent or by impaired nutrition.

Instead of club-foot, for example, being considered what it really is, a mere distortion of parts originally well formed, the popular notion is, that it depends on a defici-

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tion which may be offered to Guerin and Duval's valuable writings is, that, following the habit of many of their countrymen, they entirely overlook the labours of their predecessors in other countries. Thus they take credit for originality in the same opinions on the etiology of varus, which the author put forth in his dissertation four years before the publication of Guerin and Duval's works —opinions derived from the study of the same materials possessed by himself as well as by them —Nature and the writings of those who preceded him.

ency of some of the parts of the limb; that it is a *malformation*, a *monstrosity*, a *lusus naturæ*, or an *arrêt de développement*. This, like other almost equally obsolete opinions of the medical profession, has obtained a firm hold of the minds of the public, and will retain it for generations after the advance of science has introduced other explanations of the nature of the disease. Believing also that it is solely a misfortune afflicting the infant anterior to birth, its production has been attributed, like that of other so-called malformations, to some occult maternal influence acting upon the embryo—to the strange ideas and freaks of imagination which occasionally affect pregnant women.

Many women who have borne children afflicted with Talipes suppose that the cause of the deformity has been an ordinary fright received during pregnancy; others assert their conviction that a more alarming fright, consequent on having seen a person affected with a similar deformity, has produced the misfortune of their infant. I have, however, been informed by many mothers who have brought children affected with club-foot to me, that they neither recollected having had any particular fright, nor having been shocked by seeing distortion in any person during their pregnancy. Indeed, several mothers have mentioned that until they beheld the deformity of their infants they had never seen a club-foot, or had any idea of the existence of such deformity. I have met with exceptions in the cases of accomplished and talented females, who distinctly recollected having seen with pity during pregnancy suffering mendicants similarly deformed. A case recently occurred in which a lady gave birth to an infant affected with Talipes valgus, which she referred to her having received a severe shock in traversing, whilst pregnant, the wards of a public hospital, on the occasion of the anniversary of the institution. Her attention was particularly directed to the case of a child recently operated on for a congenital deformity, and, as she assured me, she experienced a peculiar

thrill from the contemplation of the child's condition. This was a case in which the reality of the mental impression could be easily substantiated; but it is unfortunate for the believers in the influence of such impressions in producing *a corresponding* deformity, that on further inquiry I ascertained that the case of deformity which the lady had witnessed was Talipes varus, and not Talipes valgus.

It is natural that a sensitive or sympathising female should not witness misfortune without shuddering, more particularly when pregnant, and therefore as club-footed persons are numerous in our streets, it is not surprising that a woman, on giving birth to a child afflicted with so great a calamity, should recollect having received a fright from this cause. Hence a number of such instances, however commonly received may be the opinion, tend little to confirm the idea that infants become thus affected because the parent had been shocked at the sight of this deformity. The opinion that a severe fright from any *ordinary* cause is capable of inducing club-foot in the fœtus is more reconcilable with the theory of the formation of this deformity.

We are ignorant of the existence of any direct connexion between the nervous and sanguineous systems of the parent and those of the fœtus; nevertheless, as violent mental impressions exercise so powerful an influence upon the circulation of the parent, it is not improbable that derangement of that of the fœtus may be thereby produced sufficient to injure the imperfectly developed and delicate brain and spinal cord of the infant, and thus induce imperfect development of other organs, and spasmodic contractions of various muscles, and consequent deformities.

External injury to the limbs during fœtal existence—such as pressure by the parietes of the womb, or the limbs becoming entangled, and compressing each other—is the next cause more generally admitted as the source of these deformities. I shall briefly dismiss the consideration of this alleged cause. It will suffice to inquire—even if the

relatively large quantity of liquor amnii in which the fœtus is submerged did not, at the early period of uterine existence at which these deformities are to be found, oppose an effectual obstacle to the exercise of pressure upon any portion of the fœtus apart from the remainder,—how is it possible that pressure of the walls of the uterus, a mechanical cause acting from without, should affect the fœtal limbs, by disturbing the arrangement and development of certain muscles and bones according to certain invariable rules, instead of acting in an uncertain manner, as external mechanical agents act when brought in collision with the living body? It is more in accordance with pathology to search for some cause resident within the organisation of the fœtus.

This cause is, for the most part, if not wholly, disturbance of the nervous system of the fœtus, in whatever manner this disturbance may be induced.*

At the commencement of this lecture I remarked the identity of causes of *contractures* and congenital distortions; and, as I have stated, that the former occasionally arise from accidental circumstances, such as repose of a limb in a certain position, it is proper here to inquire whether this cause may not sometimes operate in utero. The possibility of this cannot be denied; but observation of all the facts with which I am acquainted bearing on this question, leads me to the conclusion that such is not the cause of club-foot, club-hand, and congenital distortions in general. (See Malformations.)

[An attentive consideration of the morbid anatomy of club-foot (see next Lecture) will convince the reader that a mechanical cause acting from without, such as malposition in utero, is incapable of inducing a determinate disarrangement of the tarsal bones, such as obtains in varus.

* The reader is referred to the lecture on spastic rigidity of new-born infants for information respecting those distortions, the origin of which, either a short time before or after birth, may appear doubtful.

No other cause than augmented tension of the muscles inserted into the anterior portion of the tarsus can be acknowledged to be capable of producing the peculiar displacement of the navicular bone characteristic of this distortion. (See figures 110 and 111.)

Malposition in utero may in some cases, *towards the close of gestation*, operate in producing an imperfect position of the feet at birth, a slight distortion, similar to Talipes equino-varus (p. 100), but not complete varus. The position in question is not unfrequently witnessed in large new-born infants; but the characteristic displacement of navicular bones is absent, and the feet spontaneously, or with the aid of manipulations, assume within a few weeks after birth a perfectly natural position.

But it is possible that other causes besides dynamic disturbance of the muscles—other causes than those which operate directly through the medium of the central organs of the nervous system, may produce the deformity of varus. For example, a ligature upon a limb, such as may be produced by entanglement of the limbs by the umbilical cord, may so disarrange the normal development of the limb—may perhaps sufficiently compress the posterior muscles of the leg, as to excite unwonted structural shortening of the compressed muscles, and consequent deformity of the foot in a direction which will be determined by the particular muscles of which the development is interfered with by the string-like compression. (See Lecture on Malformations.) Guerin (*Mémoire sur l'Etiologie générale des Pieds-bots congénitaux:* Paris, 1841,) describes a case of flattening of the feet, but not true varus, produced by uterine pressure.

Even the admission that entanglement of the limbs may possibly produce interference with development, and cause deformity, although this may not be typical Talipes, and the inquiry into the proximate cause of the abnormal movements which precede the entanglement, leads the pa-

thologist back to the nervous system as the organ primarily lesed.

During uterine existence the *ordinary* movements are automatic, unconscious, or reflex. These do not lead to entanglement of members by umbilical cord or with each other; for whilst these movements are, during gestation, the rule, Talipes is the exception. When the intra-uterine movements become *extraordinary*, as is acknowledged to be occasionally the case previously to the birth of infants affected with Talipes, if the excessive movements and Talipes be admitted to stand in another relation than that of coincidence, it may be asserted, according to sound physiological pathology, that the excessive movements are the result of derangement of the nervous system. According to this view of the matter, the act of entanglement, although an apparent link in the chain of causation, may be left out of consideration, and derangement of nervous system and the deformity stand in immediate relation as cause and effect.

The only objection to the dynamic origin of Talipes, as opposed to the mechanical, to which it is necessary to allude, is one derived from the observation of the results of the treatment of the deformity. It has been asserted that, after relief of the deformity, any indication of perturbed muscular or contractile action is never observed, and that the muscles previously contracted become perfectly developed. These observations are entirely opposed to the results of experience. Every surgeon who has treated even a few cases of congenital club-foot is cognisant of the tendency to relapse, or that, after complete flexibility of the ankle has been obtained, the neglect of certain manipulations and exercises is often followed by return of considerable contraction. Now it is obvious that if the dynamic property of the muscles of a joint be intact, and entire flexibility be obtained, either with or without operation, no tendency to relapse should exist; for if the muscles

originally contracted be right in their functional activity, ordinary exercise would, as in the case of a sound limb, maintain the flexibility. But although volition exists in the former structurally shortened muscles of a recovered club-foot, a tendency to re-contraction—tonic contraction—does in many cases (especially those most affected) exist; and in the majority of recovered club-feet, whether treated by instruments or tenotomy, perfect development of muscles does not ensue. As volition exists in the contracted muscles of congenital club-foot, as well as in certain non-congenital cases (spastic or tonic contractures) both before and after operation, a further analogy between congenital and non-congenital deformities exists. Both kinds are primarily caused by tonic contraction of certain muscles, followed, in proportion to the duration of the deformity and activity of the period of development and growth, by structural shortening. In many cases, especially the congenital, and in many non-congenital cases, the tonic or dynamic cause of distortion has subsided—the deformity being only maintained by structural shortening. When this is obviated by treatment, the cure is complete as far as the muscles are concerned, and the deformity is on this account little inclined to relapse. But if in congenital or non-congenital cases the dynamic cause is still in operation, difficulty in maintaining the cure is experienced.]

LECTURE XV.

[*Varieties of club-foot—Congenital Talipes equinus*]—*Congenital Talipes varus—Characters and morbid anatomy—Opinions of older and modern authors—Importance of studying the anatomy in infants with reference to etiology, and of adults with reference to cure—Treatment in the infant—Treatment of adult T. varus.*

Congenital Talipes equinus.

[Several varieties of congenital club-foot exist. The most simple, but at the same time the least frequent affection, is Talipes equinus, arising from congenital shortening of gastrocnemii muscles. The individual walks solely upon the point of the foot, upon the toes, or upon the ball of

Fig. 99.

Congenital Talipes equinus. The deformity of this foot appeared greater in the act of walking than it is here represented, owing to the toes then turning inwardly.

the foot, without the heel or any of the posterior part of the sole touching the earth. The heel may be more or less elevated from the ground, from half an inch to five or six inches, according to the age or degree of severity of the disease. There may also be a difference in the manner in which the individual treads, as the weight of the body may be borne either upon the front part of all the metatarsal bones, which constitutes a pure case of Talipes equinus; or the person may be inclined to tread more upon the little toe, or upon the great toe, when the deformity approaches the other forms of foot-deformity.

The tendency evinced in T. equinus congenitus to turn either inwardly or outwardly towards T. equino-varus or T. equino-valgus, is not dependent upon primary affection of either the adductor or abductor muscles of the foot, but upon the form of the astragalus.

In proportion to the degree of elevation of the heel, and the intensity of the contraction of gastrocnemii by which it is held in the abnormal position, the articular facets of the astragalus are projected forwards from beneath the tibio-tarsal joint, the narrow part only of the astragalar articulating surface being situated between the malleoli; hence, during a state of repose, and before the infant walks, a slight inversion of toes is added to the original deformity, or, when the individual walks, the toes incline inwardly or outwardly as described.*

The knowledge that the healthy foot possesses four normal movements, with corresponding sets of muscles for their production, and that after birth at least as many foot-

* So uncommon is a pure congenital T. equinus, that its existence has been denied. The case from which the drawing is taken was the eldest son of a surgeon, who assured me that the foot had not perceptibly varied in form since birth. The case, and its treatment with the aid of tenotomy, was published in detail by the father in the *Lancet*, 1838. The mother of this patient subsequently bore nine robust, well-formed children. The eleventh and last of the family was born with similar distortion, and recovered by mechanical treatment without surgical operation.

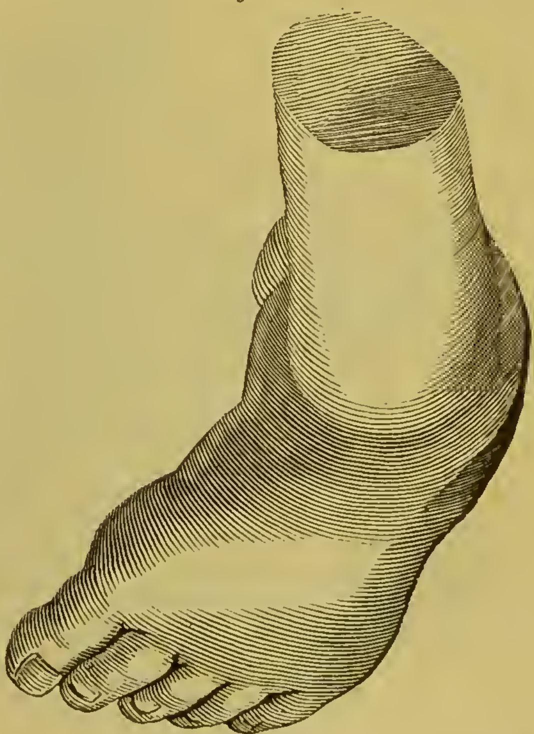
contractions occur as there are natural movements and corresponding sets of muscles, with the belief that morbid muscular action in the fœtus is the cause of congenital distortions, would *à priori* suggest that the congenital deformities of the foot would be as numerous as the non-congenital ones. Observation proves this surmise. (The reader is referred to the diagram of non-congenital deformities, p. 172 of these Lectures.)]

Congenital Talipes varus.

The number of instances of congenital varus probably equals that of all the other congenital distortions added together.

The frequency of this particular distortion corroborates the opinion of its origin from a lesion of the nervous system, as it corresponds with the greater frequency of non-congenital spastic and paralytic deformity of the ankle than other non-congenital distortions. I have, in a former lecture, attributed the proved greater frequency of deranged action of the muscles of

Fig. 100.



Slightest degree of congenital club-foot: It may be classed with varus, because it presents in a slight degree the threefold change of position characteristic of that deformity. The figure represents the foot hanging down, unsupported beneath the toes, from which circumstance the elevation of heel is made to appear disproportionately great.

the foot and ankle to the greater tendency to disease of the parts of the nervous centres from which the nerves distributed to the parts most distant from these centres arise.

T. varus may exist in various grades of severity; it may be so slight, as at fig. 100, that it appears to be merely an unnatural increase of the propensity of children to turn the feet inwardly. It may affect one or both feet. In the majority of cases the deformity presents the appearance of this model (fig. 101). It consists of a threefold alteration

Fig. 101.

Congenital Talipes varus in a youth aged 16. This drawing shews that those points of the bones of the tarsus which appear in the dissected foot unnaturally prominent, may also be occasionally seen projecting through the skin on the instep.

of position of the foot in relation to the leg,—elevation of heel, adduction or inversion of the toes, and a rotation of the foot, analogous to supination in the upper ex-

tremity. The patient treads on the outer margin of the foot, principally on the external edge of the metatarsal

Fig. 102.

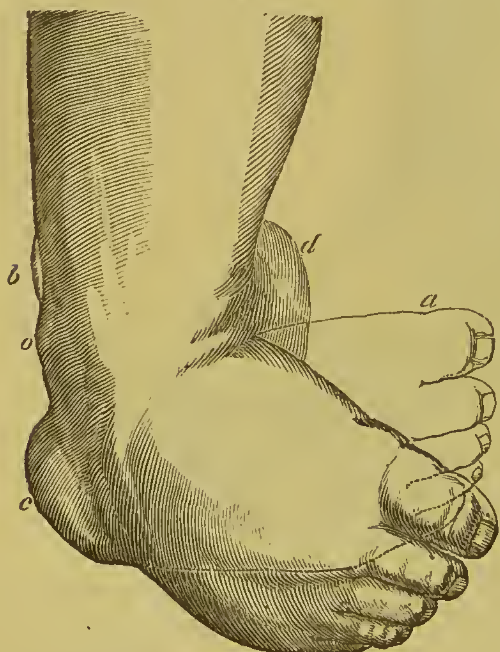
The same foot as the preceding, viewed from behind. It exhibits the state of extension of the foot; the approximation of the heel, *h*, towards the ball of the great toe, *b*; and the unnatural concavity of the sole, the latter being produced by the contraction of the tibialis posticus, flexor longus pollicis, and the muscles of the sole. The letter *a* in this and in fig. 101 indicates that portion of the outer edge on which the individual trod on first placing the foot to the ground; but when in the act of walking he attempted to throw the weight of the body upon the limb, the toes were thrust more inwardly, and the tarsal bones outwardly; by which means the various eminences seen (fig. 101) on the outer surface of the tarsus were brought into contact with the iron worn upon the outside of the limb. In consequence of their exposure to considerable friction, they were covered with indurations of the cuticle. Both feet were affected in a similar manner, but the left foot to a greater extent.

bone of the little toe; and if the deformity be unrelieved, it increases as the child grows.

This increase is in part attributable to the improper manner in which the weight of the body is borne by the extremity. The perpendicular axis of the limb, instead

of passing through the arch of the foot and the sole, falls to the outside of the little toe; so that in the act of progression the toes gradually incline more inwardly, whilst the dorsum of the foot tends towards the ground,—see fig. 103. (Compare with this tendency of congenital distortions the progress of non-congenital foot-deformity, p. 142.) The preponderating action of the adductor mus-

Fig. 103.



Congenital Talipes varus of the right foot in a child aged two years and eight months. The drawing represents the foot in the position to which, prior to the commencement of the cure, it could be reduced by pressing the toes and front part outwards. The outline of the front part of the foot *a* shews the extent of the deformity when relinquished to the free action of the muscles, or when the child attempted to walk. The letter *b* indicates part of the external malleolus, presenting more posteriorly than in the sound foot; *c*, a callosity protecting the os cuboides and its articulation with the os calcis from the effects of pressure; *d*, the heel elevated to the utmost extent behind the tibia and fibula; o, external angle of the trochlea of the astragalus, visible through the integuments in consequence of the elevation of the heel.

cles also augments this deformity. Ultimately the dorsum only is applied to the ground. Occasionally the deformity presents a higher grade,* even at the moment of birth, the toes being not merely inverted to a greater degree, but so much elevated by the action of the anterior tibial and extensor proprius pollicis muscles, that the inner margin of the foot is nearly applied to the tibia, as in these models (fig. 104). Whether the deformity reach

* Dieffenbach makes five grades of varus; it is sufficient in practice to distinguish three only, as represented figs. 100, 101, and 104.

the severest grade at birth, or subsequently attain it through the operation of the causes I have mentioned, it may, during adolescence and adult age, present the most frightful deformity, as represented figs. 105 and 106. Locomotion is, in these cases, wholly effected on the dorsum, or, more accurately, on the anterior extremity of the os calcis, and the proper superior surface of the os cuboides. The mode of progression is very unsightly, one foot being lifted over the other, to prevent the toes of one foot striking against those of the opposite member.* The parts of the foot applied to the ground suffer much from the friction and pressure to which they are subjected in walking; a globular callosity forms over the os cuboides and adjacent bones, which often equals in size a small orange.† When it attains this magnitude the patient, if young, and therefore less experienced in locomotion, unless assisted by appropriate shoes, expe-

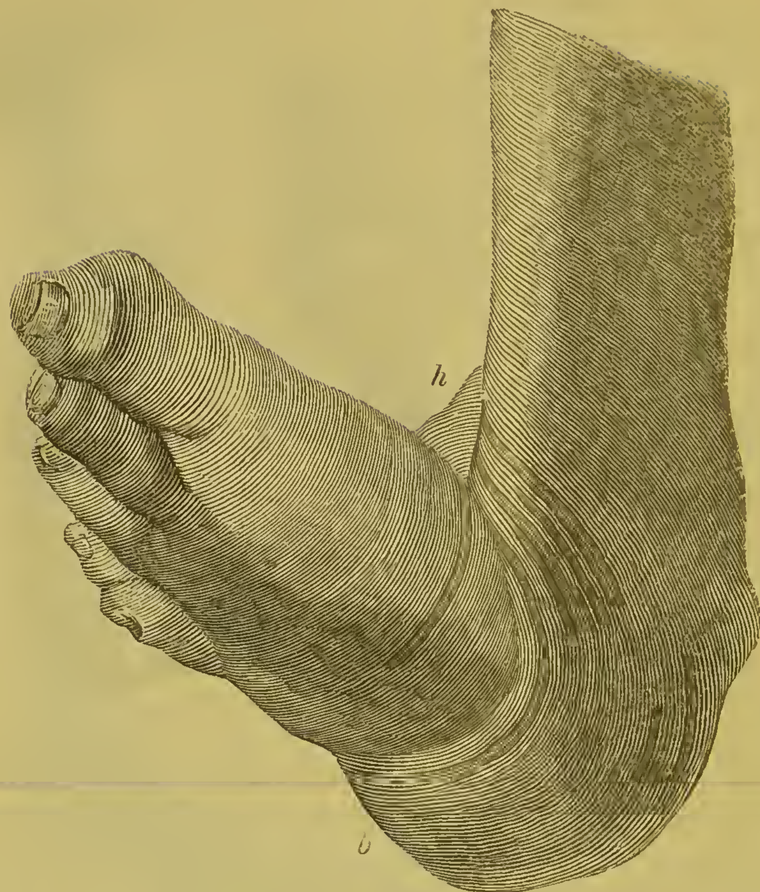
Fig. 104.

Most severe grade of infantile congenital T. varus.

* Club-foot is popularly designated by other names, *e. g.* bumble-foot in Somersetshire, reeled-feet in Ireland, &c. (For the various modes of walking see *De Taliped. Varis et Valgis, L. D. Goepel:* Lipsiæ, 1809.)

† This "callosity" is sometimes an adipose cushion, sometimes a bursa (see *Symbolæ ad Talip. cognos.* W. J. L., 1837), which promptly disappears after a few weeks disuse of the limb.

Fig. 105.



Front view of an adult congenital T. varus. Shewing the deformity of the tarsus and the swelling (*b*) which result from the attrition to which the back of the instep is subjected; *h*, the heel. A similar deformity of both feet existed in the subject from which the drawing is taken.

riences difficulty in standing still, although he may be enabled to walk and run quickly. Sometimes, except when seated, his condition becomes one of perpetual motion; the comparatively small extent of surface on which the body rests occasions difficulty in maintaining its balance in the erect posture, and the sufferer continually moves to avoid falling. It often happens that the highest grade of deformity occasions less difficulty and pain in locomotion than the slighter grade; in this the weight of the body may be

Fig. 106.

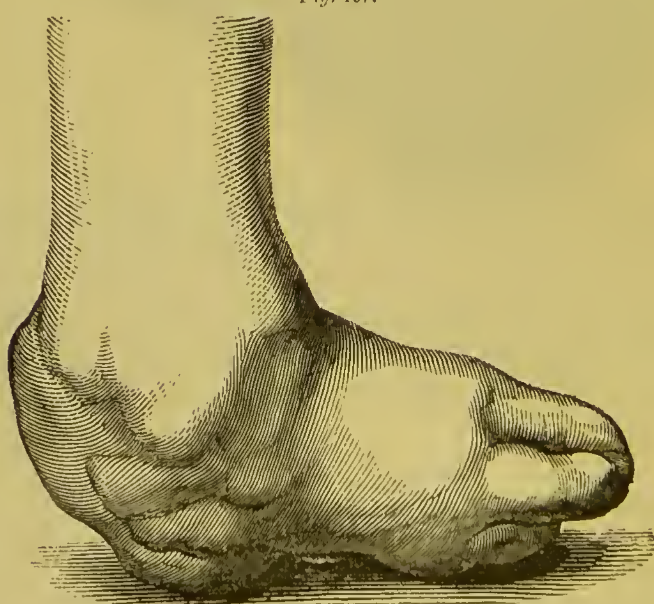
Represents the same foot as fig. 105, *in the reverse position.* In this example of the highest grade of deformity, the sole of the foot is completely vertical, instead of horizontal. The letter *h* indicates that surface of the heel which in the natural state of the foot would touch the ground, whereas it is here presented directly backwards; *b*, the tumour formed of successive layers of thickened cuticle, cutis, and thickened adipose, ligamentous, and periosteal tissues, constituting a cushion on which the patient walked. The outline of this tumour is seen to be better defined upon the posterior aspect of the foot than upon the anterior aspect.

wholly thrown on the little toe.* The extent of surface

* These drawings are added for the purpose of shewing the features of extreme varus when unchecked by art. They may hereafter only possess an historical interest, for such instances are even now less common than a few years since; the greater number of adult cases bearing some traces of the interference of art.

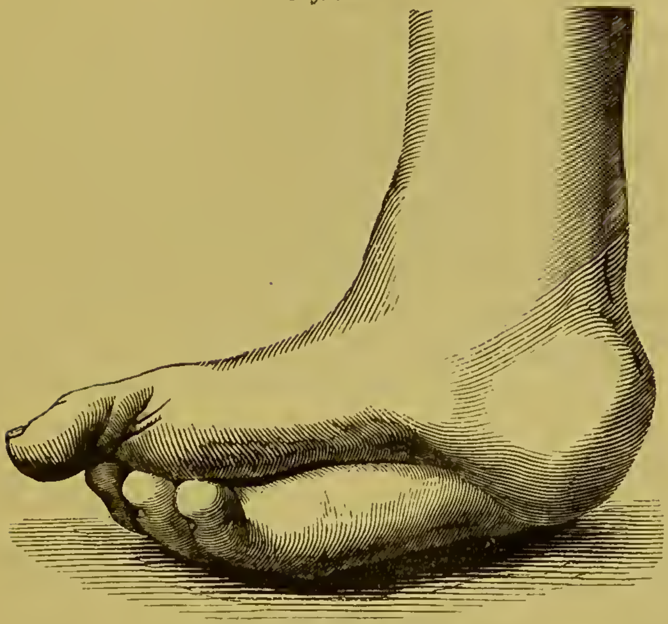
applied to the ground in these cases being small, it becomes inflamed and excoriated; besides which, a greater sensation of weakness is experienced, owing to the constant tendency to increase of inversion, whereas in the highest grade, the inversion having attained its maximum, a firmer bearing is obtained. The act of locomotion with increasing age becomes more laborious. I have known many persons thus affected who have walked twenty or thirty miles in a day; but it usually happens that so great a soreness results from one day's exercise, that the individual is compelled to rest for several days afterwards. Occasionally the callosity on the dorsum ulcerates or sloughs, the tarsal bones become exposed, affected with necrosis, relief having been often sought in amputation. Within the last three years (1843) amputation has been performed in this metropolis for removal of T. varus, in cases in which ulceration did not exist. I shall be enabled to prove to you that no case of T. varus ought to be amputated, un-

Fig. 107.



Adult congenital T. varus aggravated by use.

Fig. 108.



The subject of fig. 107 *viewed posteriorly.*

less such an amount of *disease* of the tarsal bones should exist as would render amputation in a well-formed foot necessary. One foot only may be affected.

[The figs. 107 and 108 illustrate one of the secondary alterations of congenital varus, the folding of the sole resulting from use of the limb. The particulars of treatment of this case were published in *Treatise on Club-foot, &c.*, Appendix, Case XXIII.]

T. varus is attended with inferior development of the entire member; this is more striking in the parts below the knee. Sometimes this deficiency is not perceptible at birth, but becomes evident as the age of the individual increases. Its extent at birth, as well as the severity of the deformity, depend, in my opinion, upon the earliness of the period of intra-uterine existence at which the deformity arises. As in extra-uterine life spasm and paralysis partially arrest growth and induce *atrophy*, so in the fœtus this circumstance results; and it follows, that the later the period at

which the fœtus becomes affected, the less *arrêt de développement* the members generally will present. You will readily understand that as, in childhood and adolescence, a greater or less intensity of muscular contraction will produce a corresponding severity of deformity; so in the uterus the severity of the cause will, in a great measure, determine the grade of deformity. But it should be further remarked, that in proportion to the earliness of the period of infancy and adolescence at which a deformity arises, the more readily the bones and ligaments yield to the displacing power of the muscles. From analogy, therefore, it may be inferred that, as at an early period of embryonic existence the bones and ligaments possess little capability of resisting displacement, the earlier the muscles are excited to abnormal activity the more severe will be the deformity, and the arrest of development of the bones and other structures of the affected members. In considering this explanation of the intra-uterine origin of club-foot, you will remember the fact of the muscles being characteristically developed in utero earlier than the passive tissues, the bones, ligaments, and cartilages. The muscles are developed between the third and fourth month of gestation, which corresponds with the existence of T. varus in four-month fœtuses, several of which I have anatomically examined. In corroboration of this view of the origin of T. varus, I may also mention the fact of the earlier development of the flexor and adductor than of the extensor and adductor muscles. This fact will tend to explain the greater frequency of T. varus than T. valgus. Congenital talipes is sometimes accompanied with deformity of the knee; this may be slight, and for a time elude observation, or it may consist of slight inversion (as in fig. 104), the patella (often very small) being situated too near the outer margin of the limb, the biceps femoris slightly contracted, and the flexion of the knee impaired as regards its direction. In other cases more severe deformity of the knees,

sometimes complicated with derangement of the motion of the hip, exists. Complete flexion of these articulations may be present; the case then presents the greatest resemblance to spastic non-congenital universal contractures (see Lecture IX.). Other deformities may coexist.

Morbid Anatomy.—The greater part of that which has been written on this subject appears to have been derived from investigations of the feet of individuals who had long availed themselves of the imperfect use of their limbs, and in which the deformity had been aggravated from friction and pressure.* The anatomy of T. varus can only be

* Some portion of that which has been written on the morbid anatomy of varus has rather retarded than advanced the subject, inasmuch as few authors have studied it in infantile subjects, although so essential, as the condition of the limb becomes at a later period much affected by continued action of the dynamic cause of the distortion and by external agents. It will be presently shewn, that many of the published dissections have been made on adult subjects; and that the assertion of Scarpa, that the opinions derived from dissections of the feet of adults would be as numerous, and differ as much, as the feet dissected, is partially correct. Some appear to have conjectured the internal arrangement of the bones merely from the external form of the foot. It may also be remarked, that many of the authors hereafter quoted have not stated whether the case examined was congenital or otherwise.

The various opinions of the best authorities may be arranged in three classes, and stated as follows, viz.

1. That the primitive formation of the bones is unnatural and incomplete.

2. That the bones, being originally perfectly formed, become injured and distorted by causes independent of the formative process, viz. by pressure occasioned by the fœtus drawing the limbs into unnatural positions; by an improper situation of the fœtus in the uterus; or by certain ligaments becoming elongated, and the articulations distorted, from contraction of some of the muscles and relaxation of others.

3. That, whatever may have been the condition of the bones on the occurrence of distortion, the act of walking displaces and injures them.

Glisson and Camper* were of opinion that varus† arose from deformity,

* The author has not consulted the original work of Camper, which is in the Dutch language, and entitled *On Shoes, and the Evils occasioned by them.* He has followed the statement of Scarpa.

† In this summary the designation of the disease adopted by the respective authorities quoted, is employed, except in the expression of the author's own opinions, when the disease is denominated Talipes varus.

determined with accuracy from the inspection of infantile examples of the deformity, as well as adult ones. Hypothesis supplied the place of observation; for, as some pa-

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or even destruction, of the astragalus, and that the affection was consequently incurable. Blumenbach[*] attributed the principal cause of varus to an unnatural shortness of the neck of the astragalus. Naumburg[†] and Wanzel[‡] considered this bone to be distorted and displaced. Brückner[§] combats the opinion of the dependence of varus on a partial luxation of the tarsus. Scarpa[||] ascertained the existence of only slight deformity of the individual bones, and that the os scaphoides, os cuboides, and os calcis, were displaced; whilst the astragalus was the least affected, and was invariably more or less completely situated within the articular cavity formed by the tibia and fibula.

Jörg[¶] dissected two feet affected with varus: one, of a man aged sixty years; the other, of a boy aged thirteen. In the former, the shaft of the tibia was twisted anteriorly and outwardly, so that the internal malleolus, which was smaller than natural, presented forwards; while the external malleolus had receded. The articular surface of the inferior extremity of the tibia had undergone so great a change as to be scarcely recognisable, being adapted to receive the astragalus, which was so distorted as to resemble the segment of a sphere, the remains of its round head being directed outwards, and the posterior part turned inwardly; the whole being rotated on its perpendicular axis, and inclined forwards and downwards. The ginglymoid articulation of the ankle was consequently converted into a ball-and-socket joint. Observation demonstrates that this conversion of the ginglymus into an imperfect enarthrosis is the result of attrition (usure). The part corresponding to the round head was not invested by the os scaphoides; the tuberosity of the os calcis inclined inwardly, and its anterior process outwardly; the entire bone was rotated, so that the external margin presented downwards, and the inferior margin inwardly. The os naviculare had advanced towards the internal malleolus, and its internal extremity had become raised. The position of the os cuboides was altered, so that its external portion was

* Geschichte und Beschreibung der Knochen des menschlichen Körpers: Göttingen, 1786, p. 440.

† Abhandlung von der Beinkrummung, von J. S. Naumburg, 8vo: Leipzig, 1796.

‡ Dissertatio inauguralis medica de Talipedibus Varis, auctore D. M. Wanzel: Tubing. 1798. Wanzel had been affected with Talipes varus, and described the successful plan of treatment he underwent in Switzerland.

§ Ueber die Natur, Ursachen und Behandlung der einwärts gekrümmten Füsse. A. Brückner: Gotha, 1796.

|| Memoria chirurgica sui piedi torti congeniti dei fanciulli, e sulla maniera di corregere questa deformità, di Antonio Scarpa, 4to: Pavia, 1803. The drawing of the arrangement of the tarsus in Talipes varus, contained in Scarpa's work, corresponds in all material points with that published in these Lectures, fig. 43.

¶ J. C. G. Jörg über Klumpfüsse, und eine leichte und zweckmässige Heilart derselben: Leipzig und Marburg, 1806, pp. 15-23.

thologists assumed that the deformity depended on malformation of the bones, they concluded that very extensive changes in form and structure of these must exist. I am

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applied to the ground. In the other case related by Jörg, the deformity had reached the highest degree; but the form of the individual bones being unaltered, the description of the dissection corresponds with the opinions of Scarpa. Clossius* describes this as likewise the case in one of the feet of a man stated to be affected with varus in both extremities. In the other foot, wherein the external deformity was greater, the round head and neck of the astragalus were directed inwards and downwards, being flattened on their internal surfaces; the superior trochlea of the astragalus was altered in its position, so that a considerable portion of its superior surface was not opposed to the tibia, this bone having caused the formation of a new articular surface on the posterior part of the body of the astragalus; and the external surface of the trochlea, by protruding anteriorly, was not in contact with the articulating surface of the external malleolus. Clossius further relates, that the os scaphoides was connected in the most perfect manner with the three cuneiform bones, but that it almost touched the internal malleolus.

Colles† concluded, from two dissections of varus (the one a child of five years, the other a youth aged eighteen), the existence of several grades of varus, and that distortion of the individual bones resulted from their displacement, and the injury arising from walking. In the former, many of the muscles had assumed the colour of adipose tissue, but retained their fibrous structure; the tendons of the tibial muscles were disproportionably long, and, in consequence of the deformity, had swerved from their natural direction. The internal malleolus was situated more forward than the external malleolus by upwards of an inch; the superior surface of the trochlea of the astragalus was divided by a transverse ridge into two portions, which he considered would have presented a serious obstacle to the replacement of the foot. The os scaphoides was drawn inwardly from the round head of the astragalus. The other case presented less deformity; but he concluded that the oblique position of the tarsal joint, and the altered form of the astragalus, were the primary causes of the distortion.

Mackeever‡ investigated the anatomy of three cases of congenital distortion in infants: he found that the tuberosity of the os calcis touched the fibula, and that the os naviculare was in contact with the internal malleolus, and adherent by strong bands of fibrous tissue; on division of which the foot was readily restored to its natural position. The tarsal bones differed but little from the normal state; the muscles were of the ordinary bulk, and

* Ueber die Krankheiten der Knocken: Tübingen, 8vo, p. 270.
† Colles' Dublin Hospital Reports, vol. i. p. 184.
‡ Edinburgh Medical Journal, vol. xvi. 1820, p. 220.

satisfied, from perusal of several professed descriptions of the anatomy of a club-foot, that the authors' ideas were derived from inspection of the living foot, and not from

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the tendons of the usual length. In those situations where the bones had come into unnatural contact, the surfaces were smooth, somewhat resembling a natural articulation.

Palletta,* finding the internal malleolus deficient in size, concluded this to be the cause of the foot being drawn inwardly by the adductor muscles. In the dissection of an infant six days old, he found that the os scaphoides was not applied to the round head of the astragalus, but had been drawn inwardly beneath the internal malleolus; the neck of the astragalus also inclined inwardly, but the trochlea was properly placed between the malleoli; the remaining bones of the tarsus followed the direction of the os naviculare. He found a similar alteration in the arrangement of the tarsus of a child twelve months old, and alludes to the approximation of the tuberosity of the os calcis to the external malleolus.

The researches of Delpech,† although valuable with respect to the pathology and treatment of the disease, add but little to the information previously acquired on its morbid anatomy.

Cruveilhier states,‡ that in his dissections of varus he observed the atrophy of the muscles to be more complete than that of the bones. In a female aged forty-one years, the nerves distributed to the muscles were much reduced in size, the neurilema being nearly the only portion remaining; the tibial arteries and veins were reduced to one half the ordinary size, and no branch distributed on the muscles had admitted any of the coloured wax with which the arterial trunks had been injected; the whole of the muscles, with the exception of the internal portion of the gastrocnemius externus, had undergone adipose transformation; the tendons were very slender, that of the gastrocnemii being developed to only half its natural size. A smooth and oval surface was formed at the extremity of the internal malleolus, by which the tibia was applied to the internal surface of the os calcis; the opposing surfaces were invested with cartilage. (A reference to fig. vi., plate 3, of Cruveilhier's work, shews the inward inclination of the os naviculare: a general correspondence exists between his representations of varus and fig. 43, p. 135, of these Lectures.) He considers the unnatural form of the bones of the tarsus in congenital varus to arise prior to ossification.

Löb§ published a description of the tarsal bones of an adult female affected with Talipes preserved in the museum at Bonn. The alteration of the articular

* Exercitationes Pathologicæ: Mediol. 1820, p. 138.
† Chirurgie clinique de Montpellier: Paris et Montpellier, 1823, p. 200.
‡ Anatomie pathologique, livraison ii. 1830.
§ Dissertatio inauguralis de Talipedibus Varis: Bonnæ, 1830.

dissection. The first great step in the elucidation of the morbid anatomy of Talipes varus was the demonstration by Scarpa, that of the several bones of the foot, the astragalus

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surface of the astragalus was in his opinion sufficient to have prevented the restoration of the foot; the upper part of the os calcis, which is rough in the normal state, presented two smooth surfaces covered with cartilage, which were continuous with the trochlea of the astragalus; so that, from the extreme state of extension in which the foot had been retained, the os calcis entered into the composition of the ankle-joint. The os naviculare had gone inwardly from the round head of the astragalus, followed by the os cuboides, leaving a space between itself and the anterior part of the os calcis. (Compare this description of the changes in position of the bones with figs. 43, 110, and 111, of these Lectures, with which it corresponds.)

Tourtual,* convinced of the importance of the study of the anatomy of varus at an early period of existence, examined the feet of an anencephalous seven months' fœtus thus affected. The navicular and cuboid bones were rotated on their axes, and with the astragalus were partially displaced; the posterior surface of the latter articulated with the tibia, instead of the superior surface, resulting from the extended position of the foot. The round head of the astragalus inclined somewhat inwardly; its superior trochlea, which appeared longer than natural, presenting forwards and inwards. The former and the anterior articular surface of the os calcis were prominent, and were simply covered with the skin and aponeuroses.† The os scaphoides touched the internal malleolus; and, contrary to the testimony of Scarpa, Delpech, Jörg, Duverney, and Chelius, Tourtual found the posterior tuberosity of the os calcis drawn towards the fibula upwards and outwards. The tendon of the anterior tibial muscle, in consequence of the inward yielding of the fore part of the foot, was twisted around the anterior angle of the tibia, and became inserted into the first cuneiform bone, after having passed behind the malleolus internus, instead of in front.‡ (Compare figs. 43, 109, and 110, of these Lectures.)

* Zweiter anatomischer Bericht: Münster, 1832.

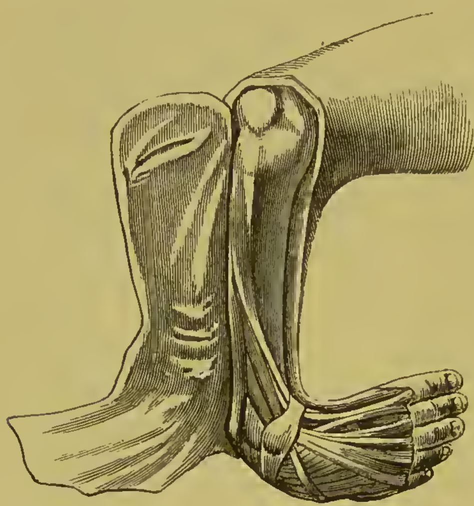
† In both feet of a nine months' hemicephalous fœtus, affected with the severest grade of T. varus, the author found the round head of the astragalus and the articular surface of the anterior extremity of the os calcis presenting downwards, and situated immediately beneath the skin.

‡ The author has never yet, in infantile cases, been able to perceive that this tendon was directed behind the malleolus internus; but has observed its course over the anterior angle of the tibia somewhat higher than natural; after which it became unnaturally inclined inwards towards the internal cuneiform bone, into which it was inserted by a band of unusual width. The inferior extremity of the tendon was, therefore, more internally situated than the malleolus internus, resulting from the altered position of the front part of the foot. See fig. 109. In both feet of a hemicephalous fœtus the whole of the muscles and tendons were much smaller than in a well-formed fœtus, having been with difficulty dissected; the entire limb was well encased in adipose tissue, precluding, from its bulk,

is the least displaced. It had been previously asserted, amongst other misstatements, that the astragalus was luxated.

As the opinions of Scarpa generally agree with the results of the author's experience, they are here detailed with less minuteness than their importance otherwise deserved. The conclusion at which Scarpa had arrived was, that of the entire tarsal bones, the astragalus had suffered the smallest degree of displacement; which alone proved the possibility of curing infantile T. varus. The determination of this point was of infinite moment, the astragalus being the most important tarsal bone, and the only one entering into the composition of the ankle-joint. Jörg, Colles, Delpech, Löh, Cruveilhier, having principally confined their anatomical observations to the feet of individuals who had passed the age of infancy, have impugned the accuracy of Scarpa's conclusions. But Palletta, Mackeever, and Tourtual, describe no alterations in children of the form or position of the astragalus, which, on removal of the obstacles to flexion or abduction of the foot, would have prevented its articular trochlea performing its functions in the tibio-tarsal cavity; although several trifling changes in the bone are related by the latter anatomists. The *essential* anatomical characters of varus are described at p. 279 of these Lectures. In every instance which the author has examined, the anterior extremity of the astragalus inclined inwardly, but only to such an extent as to cause the external surface of its trochlea to project from the ankle-joint somewhat farther than the internal surface. Fig. 111 shews that the round head is twisted inwardly apart from the general inward direction of the bone.

Fig. 109.



View of foot affected with infantile congenital varus, the integuments and fascia only having been thrown back, in order to shew the abnormal direction of some of the tendons.

any suspicion of the extent of the atrophy of the muscles. This imperfect development of the muscles is not always present in fœtuses affected with varus, as the author has observed the development to vary in different fœtuses, and occasionally to equal the natural bulk. It may be stated, as a general rule, that in proportion to the extent of the deformity is the amount of the atrophy: thus in a seven-months' hemicephalous fœtus affected with a slight grade of T. varus, the muscles were better developed than in a similar fœtus of nine months, in which the deformity was greater.

The accuracy of Scarpa's opinion has been disputed by succeeding writers; but the result of my observations of more than thirty specimens of varus, from subjects of dif-

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Weis (*De Anat. Patholog. Ped. Equini et Vari:* Arhusii, 1842, p. 10) found the extensor digitorum and peroneus brevis muscles comparatively ill developed.

Mr. W. Adams (*Transactions of Pathological Society*, 1852) has described the alterations in the form of the tarsal bones which he met with in two cases of infantile varus. His description confirms the author's opinion of the immaterial changes which the bones undergo previously to use of the part. Mr. Adams has witnessed absence of the ext. long. digitor. muscle. The author has never observed greater deficiency of this than other muscles. He has even found the long and short extensors well developed (see fig. 109). The author believes that the deficiency or atrophy and degeneration of muscles is in a precise ratio to the extent of the deformity, and the earliness of the period of uterine existence at which the deformity is produced. The fact of hypertrophy of part of gastrocnemii, observed by Mr. Adams, is an important contribution to the pathology of varus, since it shews another analogy with non-congenital Talipes, in which sometimes hypertrophy of the contracted muscles exists (see p. 14 of these Lectures).

The deviation of the os calcis is next in extent to that of the navicular bone; in a sound foot, the round head of the astragalus is principally supported by the inferior calcaneo-scaphoid ligament, which sustains a considerable portion of the weight of the body; but in severe varus the anterior extremity of the os calcis is forced inwardly as far as the round head of the astragalus, and occasionally beyond it, taking the office of the calcaneo-scaphoid ligament; and the posterior tuberosity of the os calcis is consequently directed outwardly towards the fibula. It is possible that the two following symptoms occurring in varus may have deceived several authors,* and induced the opinion that the posterior tuberosity of the os calcis had yielded inwardly:—first, the apparently inward inclination of the heel, owing to the length of the inner margin of the foot being so much diminished, and rendered hollow by the front part being drawn both inwardly and backwards. Secondly, the appearance of the anterior extremity of the os calcis on the external aspect of the foot; which is likewise a result of the inward twisting of the navicular, cuboid, cuneiform, and metatarsal bones (see fig. 30, p. 108). The extent of separation of the cuboid bone from the os calcis varies considerably, being sometimes insufficient to form the triangular interval described p. 279; but in fœtuses affected with the highest grade of deformity, denudation of the anterior extremity of the os calcis by the os cuboides is some-

* See Duval, Traité pratique du Pied-bot: Paris, 1839, p. 94.

ferent ages, is, to confirm the opinion of Scarpa, and add, that I have examined no preparation of varus in which each of the three facets of this bone, which articulate with the tibia and fibula, has not been in partial contact with the appropriate surface of these bones. The confirmation of Scarpa's opinion, and the results of my own observation, have been of the utmost importance in enabling me to determine, from pathological anatomy, the propriety of undertaking the treatment of the highest grade of T. varus, namely, that represented figs. 105 and 107.

The empirical tendency of art to advance from the treatment of the simple to the more complicated deformities would alone have confirmed my previous supposi-

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times witnessed, its entire articular surface being simply covered with the integuments.

It is remarkable that the more correct opinion, viz. that the bones are primarily unaffected, corresponds with that of Hippocrates; but whether Hippocrates considered the causes of displacement to be resident within the limb, or to arise from external influences, cannot from his language be determined: "There is more than one variety of club-foot; the most of them being not complete dislocations, but impairments connected with the habitual maintenance of the limb in a certain position" (Opus cit. p. 632). By the detaining power alluded to, he may have understood either external mechanical agents, or the unequal action of certain muscles. Hippocrates has been quoted as the supporter of the theory of varus being produced by uterine pressure (*Mémoire sur l'Etiologie du Pied-bot*, par F. Martin: Paris, 1839), upon the strength of distinct observations to this effect contained in a treatise on generation, incorrectly attributed to Hippocrates. (Translation of Hippocrates, by De Foes, vol. ii. p. 395.)

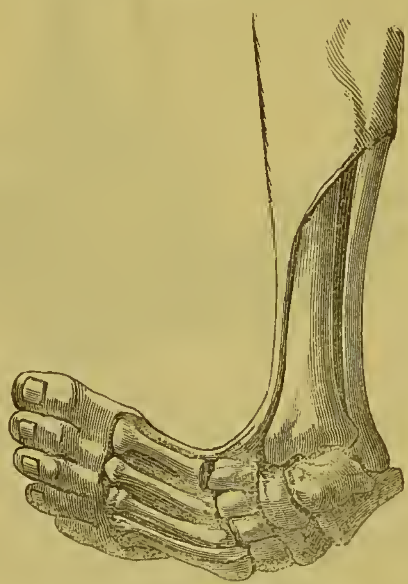
The summary of the investigations of the anatomy of varus may be concluded with the words of Scarpa:—"None of the tarsal bones are actually dislocated; but in addition to the state of extension of the ankle-joint, they undergo rotation on their axes, and the astragalus suffers less alteration of position than either of the tarsal bones."

B. Bell* alludes to Talipes in the following manner: "Limbs may be distorted in various ways and by different causes, either from morbid state of bone, or from contracted state of muscles, or both. The malformation of the bones is the effect of rickets; but the most frequent cause of distorted limbs is contraction of flexor muscles of the leg and fore-arm."

* A System of Surgery, by Benjamin Bell: 1788, vol. vi. p 281.

tions, and have demonstrated the possibility of reetifying the position of the foot in eases of this deseription. The astragalus being the only bone of the tarsus which enters into the composition of the ankle-joint, explains the importanee of determining its anatomieal eondition.

Fig. 110.



Position of bones in infantile congenital varus. The comparatively posterior situation of anterior tibial tendon is shewn.

An examination of these drawings (figs. 110 and 111) will illustrate the position of the tarsal bones in complete varus. The os calcis is drawn upwards; the tibial artieular faeets of the astragalus and its round head are exposed upon the dorsum of the foot; but the scaphoid, cuboid, euneiform, and metatarsal bones, are not merely drawn towards the sole, but also inwards and upwards [and sometimes backwards], so that the innermost point of the navieular bone touehes the internal malleolus, and has an artieular surfaee formed on it, oecasioned by eontaet and frietion. The superior or external surface of the os euboides is somewhat separated from that of the os ealeis; whereas the plantar surfaees of these two bones are turned towards each other, leaving a spaee between them externally. The course of the tendons of the muscles situated upon the front of the leg is consequently much altered. Those of the tibialis antieus, extensor proprius pollieis, and ext. long. digitorum, more partieularly the first of these, are defleeted so mueh internally, after passing over the ankle-joint, as to serve by their aetion to increase the deformity in the living subject.

Such are the essential anatomical characters of Talipes varus. According to the severity of the deformity, either of the characters before mentioned may be more or less distinctly traced. It is unnecessary to describe in detail the non-essential phenomena met with in the examination of these feet, such as osseous vegetations, and evidences of former caries of the surface of those bones which have suffered from pressure against the earth; and some other still greater malpositions of the tarsal bones, likewise the occasional result of external pressure and injury from walking, or from wearing improperly adapted mechanical instruments.

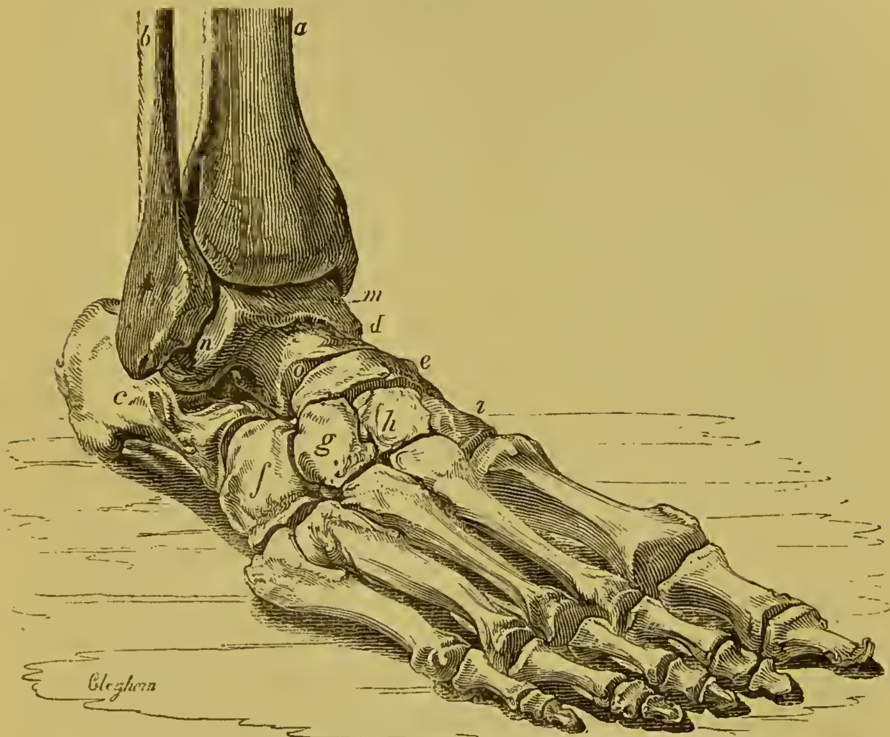
Fig. 111.

Anatomical relation of adult congenital severe varus. The extreme retroversion of the front part of the foot and doubling under of the lesser metatarsal and cuboid bones, as well as the inversion of the round head of the navicular with the cuneiform bones, are well shewn. The greater portion of the round head of astragalus is deformed, deficient in polished surface, owing to disuse and attrition against the shoe.

An attentive study of the anatomy of Talipes varus will further confirm the opinion of its origin, that the muscles are the parts primarily involved, and that the displacement of the bones is entirely secondary. If the bones were simply arrested in their development, or if they had been injured by external causes, and the contraction of muscles were but secondary, the bones would not bear so precise a relation to the action of the respective muscles inserted into them. The preparations from which the drawings are taken shew that the shortening of the gastrocnemii corresponds to the elevation of the heel, whilst the adductors and remaining muscles on the posterior and internal surfaces of the ankle have drawn the navicular, cuboid, cuneiform, and

metatarsal bones internally, upwards, and posteriorly, away from the astragalus, exposing its round head. In fact, the

Fig. 112.



Representation of well-formed male adult bones of ankle and foot, added for comparison with the non-congenital varus represented p. 135, and the congenital varus pp. 279, 280.

conjoint powerful action of the gastrocnemii and the other muscles enumerated, have bent the foot at the summit of the tarsal arch, drawn its component parts asunder, whilst the connecting ligaments were yet soft.

Treatment.—The treatment of congenital varus is not simply an empirical process of straightening that which is deformed, but an interesting subject of study, in which the etiological and pathological facts effectively direct the resources of art. The principal antagonists are the gastrocnemii and the adductors; and as a result of the malposition, the ligaments and fasciæ are variously affected, some being shorter, others longer than natural. (In many cases

the tissues of the sole are involved.) The practitioner has to determine whether these obstacles to straightening shall be removed by tenotomy or by mechanical extension.

The length of time required to effect a cure is of less consequence in children than in adults. The circumstance of children not comprehending the object of the treatment, or the necessity of the pain or irksomeness to which they are subjected — the susceptibility to the injurious effects of continued disturbance of rest peculiar to their age — their liability, when the general health is disturbed, to be affected by any of the prevailing infantile epidemics,— are reasons why children cannot, on the whole, bear as unremitted an application of mechanical instruments as is occasionally necessary in adults; it is therefore fortunate that, with reference to the degree of resistance to be overcome, the facility of effecting a cure is so much greater at this period.

Many cases occur in which the deformity may be nearly or entirely removed for the moment by pressure with the hands; but others exist in which the tension of the contracted muscles is so great, particularly of the gastrocnemii, that although the adduction and rotation of the foot may, as long as the pressure of the hand is continued, be more or less completely overcome, yet the greater part of the elevation of the heel remains. The former afford greater prospect of success by the sole application of mechanical means of cure; but in many of the latter removal of the deformity will not be obtained without division of the Achilles or other tendons, although the treatment may be commenced within a few weeks after birth, and be perseveringly continued throughout the whole period of childhood.

Experience alone can enable you to determine, with any degree of certainty, whether the cure of Talipes in an infant is obtainable by the application of mechanical means; but in the formation of an opinion you will be guided by the

extent to which the deformity can be removed by the hand, and the nature of the resistance offered by the muscles. If the active spasmodic state of the muscles still appear to exist, accompanied with considerable structural shortening, notwithstanding the foot may for a moment be reducible to its natural form with the hand, you should be less sanguine of a permanent cure by means of instruments.

I recommend, for several reasons, that in every case of Talipes,* the treatment of which can be commenced previously to the age of six months, the cure should be attempted by the application of mechanical means, provided your efforts will be seconded by the parent. Many cases are curable without operation. Interruptions in the treatment are, from various causes, more liable to occur during the earliest months of existence. If the treatment be mechanical, a temporary suspension of the extending power exercised by the apparatus is not fatal to the ultimate success of the plan; but if, after the performance of the operation at so early a period, a necessity arises for discontinuing the wearing of the extending apparatus, a loss of time occurs, during which the divided tendon firmly reunites, the cure being as distant as prior to the operation, and a repetition consequently required. When the operation is perfectly successful, and the foot entirely reduced to a proper form by the application of mechanical contrivances for a few days or weeks, it still is necessary to retain the foot in its newly-acquired position by means of apparatus until the child arrives at an age to walk (or even afterwards); for, in consequence of the tendency to contraction occurring in the medium which unites the divided tendon [and sometimes owing to the persistence of morbid action in the muscular fibre], the deformity will probably be reproduced if this precautionary measure is neglected.

Another reason for considering the propriety of treating

* The exceptions are cases like fig. 104, which from the outset, at the age of two or three months, require operation.

infantile cases without division of tendons is the objection which, on general grounds, may be made to the performance of any operation, however simple, during the earliest months of existence.

The most favourable period for the division of tendons in infantile cases of Talipes is a few months before the time when the child may be expected to make the first attempts to walk—about the age of six or eight months, until which time, in cases of Talipes varus, mechanical apparatus should be used to turn the toes outwardly, reducing the deformity to the condition of Talipes equinus; in the latter affection, whether primary or so reduced, depression of the heel may be judiciously attempted, which, if not wholly successful, will at least prevent increase of the deformity. If, by means of the operation and subsequent application of mechanical instruments, the reduction of the foot to a proper form be effected at the period when the child evinces a disposition to walk, he will rapidly acquire strength and activity. The act of walking will then, to a great extent, guard against the recurrence of the deformity; and the use of any mechanical apparatus may within a short time be discontinued. But the cure of infantile Talipes varus cannot be so completely effected, if, during the earliest months of life, the application of mechanical apparatus, calculated to maintain the toes in a straight line with the leg, by overcoming the twisting inwards and rotation of the foot, be neglected. The development of the internal malleolus and the neighbouring parts having been impeded by the adduction of the foot, or the child having walked, by which the external parts of the tarsus have suffered from attrition, also add to the difficulties.

The plan which, in private practice, I pursue in infants under the age of six months affected with varus curable without operation is simple, and which, with proper directions, can be entrusted to parents and nurses. It consists of the application of a smooth and narrow roller-bandage around

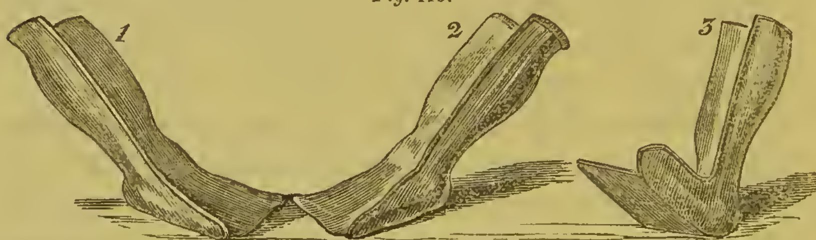
the foot and leg, from the extremity of the toes to the knee, interposing along the inner margin and sole of the foot, and the posterior and internal part of the leg, a quantity of cotton wadding, to protect those parts from pressure. The limb is then firmly and evenly bandaged in a tin splint, —the entire attention being first directed to the removal of the inward tendency of the toes, and the reduction of the T. varus to the condition of T. equinus. The limb, when properly secured in this splint, is exposed to pressure in the direction the toes would maintain if held outwards with the hands in the position of T. equinus, the inside of the metatarso-phalangeal articulation of the great toe and inside of the superior extremity of the tibia being the fixed points, towards which the bandage presses the ankle and tarsus, tending to overcome the unnatural curve presented by the deformed foot.

Much care is requisite in the application of the splint, as pressure in an improper direction might, at this early period of the development of the tissues of the foot, produce a permanent displacement or flattening of the bones of the tarsus. Several cases of T. varus which had been for years under ill-directed mechanical treatment, and in which there existed secondary alterations of form, attributable to pressure improperly exercised at an early period, have presented themselves to me. The back of the splint should be applied to the posterior part of the leg and foot, and the raised part should extend along the inside of the leg and inner margin of the foot, or occasionally along the opposite side, for the purpose of varying the pressure or of changing the action of the splint. Should the splint have slipped around the leg, it must be immediately reapplied. The whole apparatus should also be removed on every occasion that the bandages become soiled by the infant, and immediately replaced; for if the foot be permitted to remain a few hours without the restraint of the splint, more advantage would during that period be lost than had

been gained during its application for treble the length of time.

As soon as the contraction of the adductor muscles of the foot and the inward inclination of the toes is observed to be considerably diminished, and particularly if, on the removal of the apparatus, the toes are not drawn inwardly, the splint may be advantageously exchanged for another, the foot-part of which is bent more upwards. This should be applied in the same manner as the previous one, by which means a constant stretching of the contracted gastrocnemii may be maintained. Should these yield, splints, the foot-parts of which are bent to a still greater degree,

Fig. 113.



Three of the series of tin splints recommended in the text. No. 1 is adapted for the left foot, and No. 2 for the right, whilst the elevation of the heel continues considerahle; No. 3 has the foot-part much inclined towards the leg, and is consequently fitted for a case far advanced in the process of cure. Between Nos. 2 and 3, others, with the foot-parts at gradually increasing inclination towards the leg, may be employed to complete the series.

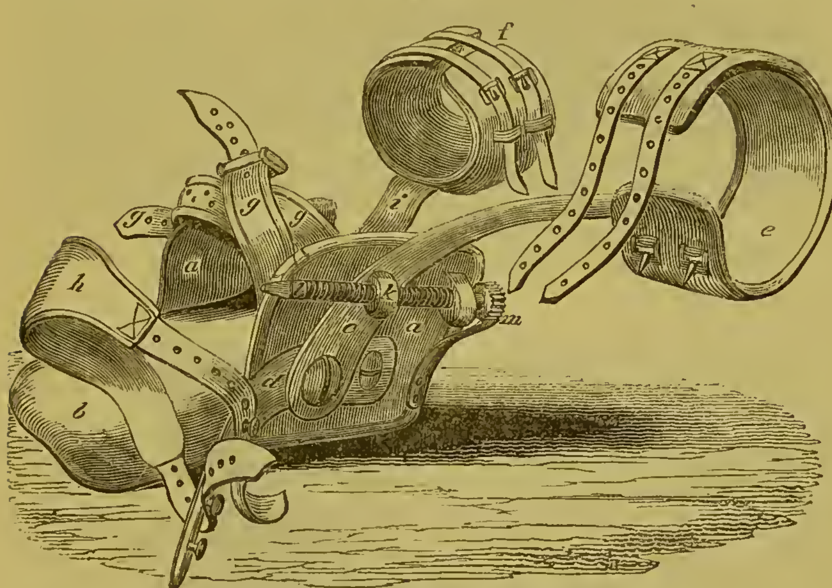
may be employed, until perfect flexion of the ankle is obtained.

On the infant attaining the age of six months, or if the treatment be postponed until this period, a more efficient instrument (see fig. 114) may be advantageously substituted. But as in the application of splints the rectification of the position of the foot must be attempted gradually, the foot-piece *a b*, fig. 114, must be screwed to such an angle with the perpendicular spring *c*, as to correspond with the obtuseness of the angle which the foot forms with the leg.

One of the more prominent causes of failure in the treatment of club-foot is the injudicious haste with which

the rectification of the vicious position is frequently attempted, and the occurrence of abrasions of cuticle and displacement of the instruments. *The abrasion results from*

Fig. 114.



This drawing represents Scarpa's shoe as modified by Stromeyer and Little, made for a left foot. The utility of this apparatus in the cure of T. varus exceeds that of any other instrument to which the author has resorted or found in use by others. Its superiority depends upon the application of an elastic power for the purpose of overcoming the resistance of the adductor muscles, the internal ligaments of the ankle, and the contracted tissues on the inside of the foot, instead of relying solely upon the inelastic pressure of screws and straps. The elastic property of steel springs, by the constancy of their action, is capable of effecting the elongation of contracted muscles or ligaments with less tightness of the apparatus than a greater amount of the pressure of screws, straps, and bandages. This apparatus is calculated to overcome the threefold alteration of the position of the foot which characterises Talipes varus, and by substituting an upright firm bar of steel for the spring *c*, is well adapted to cure Talipes equinus, whether or no any operation be necessary.

The letters *a a* and *b* designate a shoe formed of iron, covered with leather, and well padded with horse-hair; *c* is a steel spring, which, by means of the padded strap *e*, is worn upon the outside of the leg; *i* and *f* shew a strap and bandage to go round the ankle, by which the heel is held securely in the shoe. The straps *g g* hold the heel firmly towards the inside of the shoe, whilst the short spring *d* draws the toes and front of the foot outwards, by means of the padded strap *h* passed round it. The screw *l*, which moves through a female screw *k* (itself fixed as a rotatory rivet to the spring *c*), acts upon the ankle-joint, and enables the surgeon to bend it as rapidly or as gradually as he may please. The active and passive causes of the *adduction* and *rotation inwards* of the foot, analogous to supination of the hand, are overcome by the springs, which being braced up against the foot and leg more or less loosely, according to the exigencies of the case, tend constantly to regain the form which they have when unshackled by the straps, and thus gradually overcome the contracted muscles and ligaments, as the case may be, and draw the deformed foot in two directions opposed

excessive pressure, and from friction occasioned by the endeavours of the child to disengage the limb.

Whether the cure be conducted with or without an

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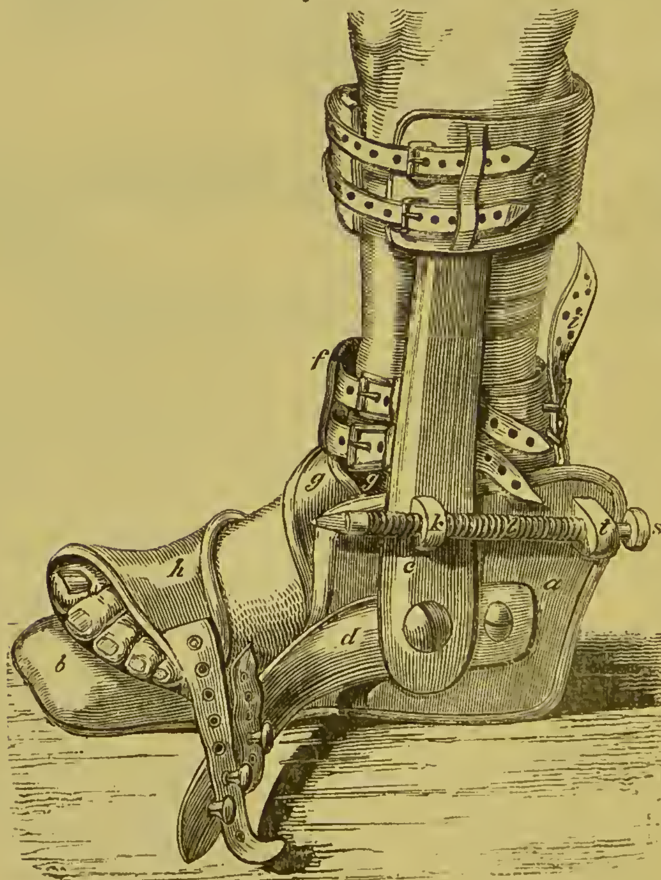
to the deformity—those of abduction and rotation outwards. If the reader, acquainted with the anatomy and pathology of Talipes varus, will put his sound foot into one of these instruments, and endeavour, whilst his foot is there, to give it the form of T. varus, he will feel how strongly the springs oppose his attempts; in fact, he will be convinced that if he wore the instrument sufficiently long, his sound foot would be converted into a deformity resembling the opposite of T. varus, namely Talipes valgus. It is at the point intermediate between these two diseases that the practitioner must stop in the treatment of the former—at the position of the foot intermediate between adduction and abduction—at the point corresponding to the natural position.

Fig. 115.*



The preceding apparatus as applied.

* Success in the employment of any particular instrument is as much the result of the manner of application as of its peculiar efficiency. A few

operation, it is of the utmost consequence to apply the necessary apparatus in such a manner that the repose of the child may not be disturbed, or uneasiness and constant fretfulness induced, which might interfere with its appetite and amusements. The welfare of a child so much depends on the necessary quantity of sleep being obtained, that the action of the apparatus should be almost imperceptibly increased; and although restlessness may at first be produced, the child will thus become accustomed to its application. The cure of Talipes would be dearly purchased at the sacrifice of general health; but the careful progress

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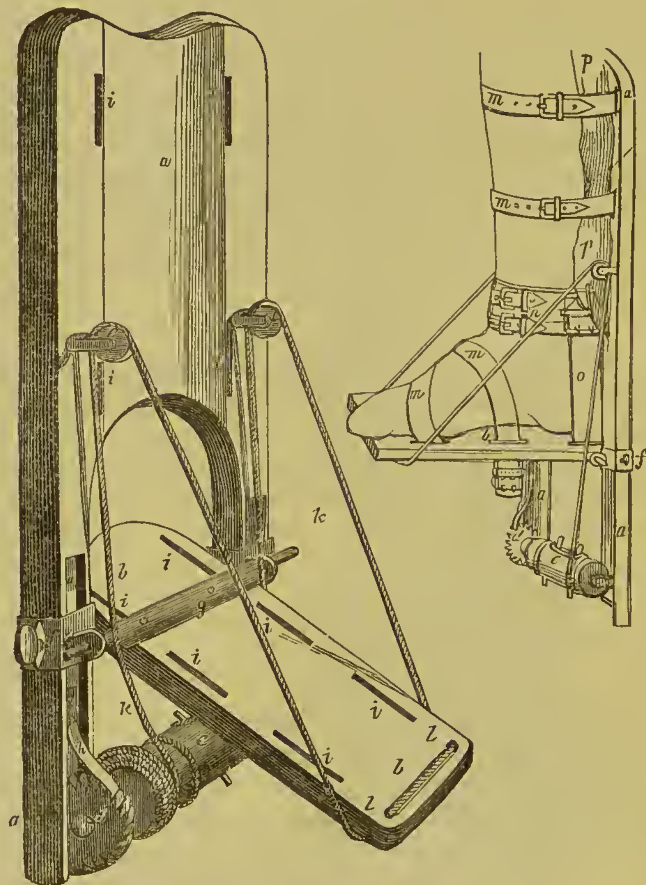
simple directions for the application of that represented in fig. 114 may not be inappropriate. A thick woollen stocking, or an elastic cotton bandage, should first be applied; if the foot is not well encased in adipose tissue, a portion of cotton wadding may be laid over the instep. The ankle-band *f*, detached from the strap *i*, should be buckled around the leg above the malleoli; holding the shoe-part of the instrument in the left hand, the heel should be placed with the right in the shoe, and secured by means of the straps *g g* firmly against the inside *a* (fig. 114). The heel should be prevented from rising by fastening the strap *i* to the back part of the ankle-band *f*; and the spring *c*, by means of the circular band *e*, formed of thin metal and properly padded, be applied to the outer side of the leg. This will effect a change in the ankle-joint similar to that ensuing in the wrist when the hand is pronated. The inner margin of the foot being then directed to the ground, in opposition to the natural tendency of T. varus, the toes should be drawn as far outwardly as can be effected without pain, by means of the padded strap *h* attached to the spring *d*; lastly, the ankle should be bent, by turning the screw *l*, with a key constructed for the purpose, as far as the tense tendo-Achillis will permit. As the screw *l* acts through the female screw *k*, which is fixed as a rotatory rivet upon the spring *c*, and *t* (fig. 115) is merely a stud through which the smooth part of the screw existing between the termination of the thread and the knob *s* can move freely forward and backward, a certain degree of motion of the ankle-joint is allowed in the act of walking, tending to increase its flexion, whilst the position of the screw *l* prevents the heel from becoming elevated. If the spring *c* act in directing the inner margin of the foot to the ground too powerfully and painfully, a piece of tape or a small strap may be attached to the inside of the band *e*, which is applied around the leg below the knee, and fastened to a buckle on the inside of the foot. This will moderate the action of the spring, which can be increased in the daytime and diminished during the hours appropriated to rest.

with extension of the contracted parts, and the removal of the apparatus once or twice daily, will uninterruptedly ad-

Fig. 116.

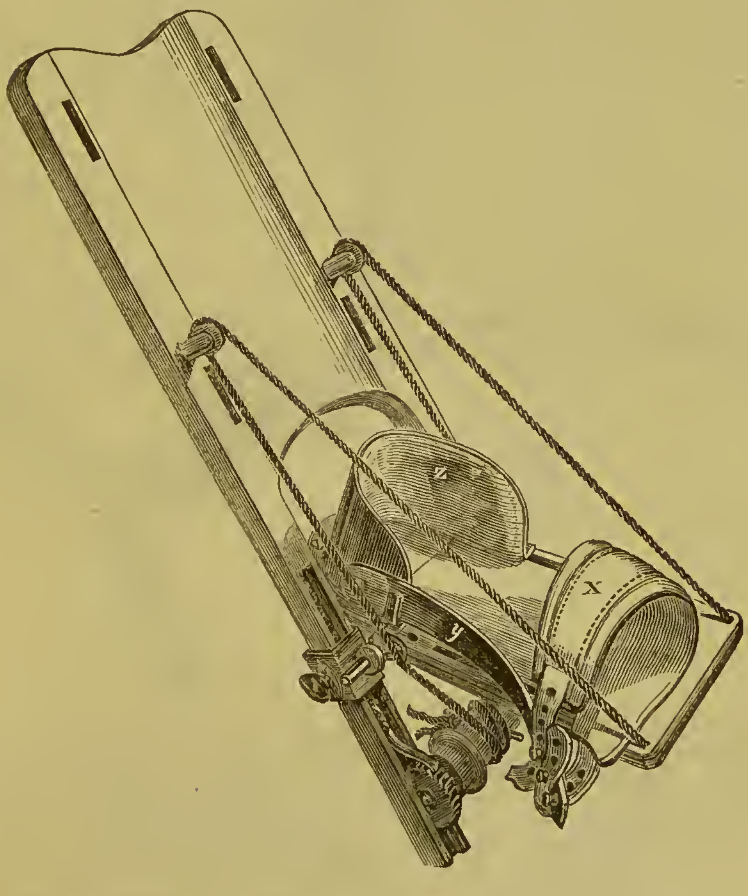


View of Stromeyer's foot-board for the treatment of Talipes equinus and varus after the division of the tendo-Achillis.—It can be applied to the right or left leg, according to the circumstances of the case. The smaller of these figures represents a foot which had been affected with Talipes equinus (such as is seen in fig. 53, page 152), nearly restored to its natural degree of bending at the ankle. The ankle formed by the foot-piece (*b b*) of the apparatus with the leg-piece (*a a a*) can be increased or diminished by turning the windlass (*c*) forwards or backwards, and by that means loosening or tightening the cord (*k k*), which, after passing through the holes (*l l*) of the foot-piece (*b b*), and over the pulleys (*e e*), is fastened to the windlass. The foot-piece of the apparatus can be rendered oblique by turning the thumb-screw and loosening the slide (*f*) through which the axle (*g*) passes. The spring (*h*), which is received between the teeth of the cog-wheel (*d*), prevents the windlass from turning backwards, except when the surgeon purposely raises it. The double row of fissures (*i i i i i*) are for the passage of the straps (*m m o m m*) by which the foot is secured in the desired position; *p p* marks a cushion placed between the leg and the apparatus.

vance the restoration of the foot, provided it be curable without operation.

In this institution I frequently recommend the operation of tenotomy in very young infants, sometimes so early

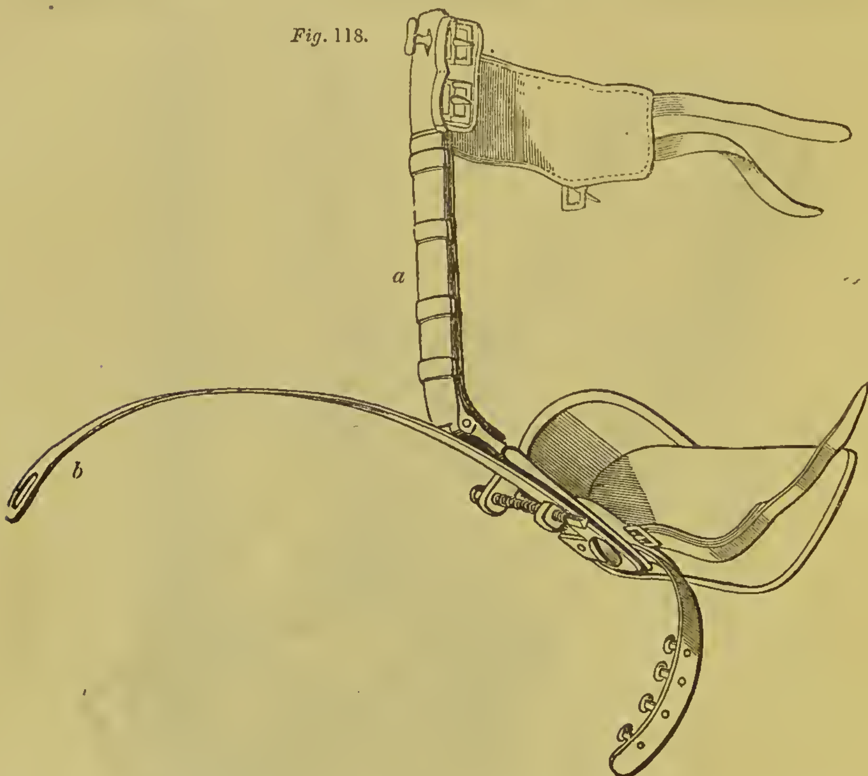
Fig. 117.



The foot-board of Stromeyer with some additions, useful during the treatment of Equino-varus. It is constructed for the right foot. The letter *z* is a heel-piece, of brass or iron plate, in the form of a horse-shoe, well padded, and destined to receive the heel, and prevent displacement of the foot during the process of extension; *y* is a steel spring, to which a padded strap *x* is attached, by means of which the point of the foot may be drawn outwards. The remaining parts of the apparatus are the same as in fig. 116. The inner part of the heel-piece is longer than the outer, in order to afford a large surface, against which the heel should be firmly secured by one or more of the nearest straps (*m*, fig. 116) being passed through the inner fissures only (*i i*, fig. 116), instead of through the fissures on both sides. The foot-piece of the apparatus is represented obliquely with the leg-part in both figures, to shew the manner of accommodating it to the obliquity of the sole.

as the age of six or eight weeks.* The circumstances that in these cases determine me in the selection of the operative in preference to the simply mechanical method are, either

Fig. 118.



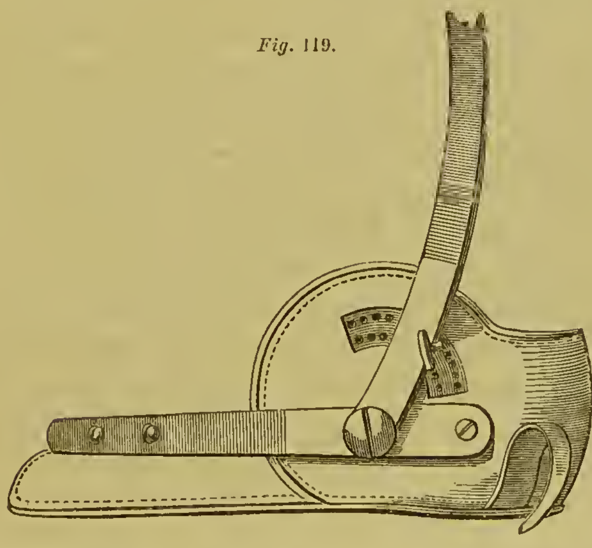
Apparatus for Extreme varus contrived by the Author.—In the treatment of the worst cases, figs. 105 and 107 for example, by the apparatus, figs. 114 and 115, he found that when by means of the screw *l* the foot was bent, the long spring *c*, owing to the resistance it encountered, became twisted upon its longitudinal axis, and ceased to act as a lever. In order to obviate this difficulty, the lever *a*, fig. 118, was added to the inside of the spring. As represented in the drawing, this lever is furnished with two hinges opposite the ankle, by means of which it can be adapted to the generally curved form of the external part of the tarsus and ankle, whilst the sole-piece is at the same time made vertical, and adapted to the vertical position of the sole. After the foot and leg are secured in the foot-piece, and the lever is fastened around the leg, the spring *b* is brought into a line with the lever, and secured to it above, either at a suitable distance by means of tape, or if its full power is wanted, by the stud at upper end of *a*. This apparatus has borne the test of ten years' service, and with the aid of tenotomy has effected restoration of many of the most severe cases of adult varus. It requires the same straps as at figs. 114 and 115.

* Dr. Evory Kennedy, previously to 1840, performed the operation in an infant four weeks old. See paper by Mr. Halpin, on division of T. Achillis, in *Dublin Medical Press*, January 1840.

the extreme severity of the deformity, in which experience demonstrates the absolute necessity of the operation ; or that, from the inability of parents to devote the requisite attention to the treatment, I am aware that whatever time may be employed for the purpose, whatever pains may be taken, the result will be unfavourable. Even with the aid of the operation, the children of parents more favourably situated cannot be restored without their zealous co-operation. The same difficulty attends the treatment, among the very poor, of all diseases, the relief of which cannot be effected by the *vis medicatrix naturæ.* In the treatment of Talipes the abnormal efforts of nature tend continually to frustrate the best-directed exertions.

Many cases, then, present themselves, in which, among the less dependent classes of society, you may satisfactorily

Fig. 119.



It will be remarked, that in the preceding modifications of Scarpa's shoe the flexion or extension of ankle is effected by means of a male and female screw. The author has always found that it is not desirable to retain a deformed foot under treatment for days, weeks, or months, in an inflexible instrument. In figs. 114 and 115 a certain motion is permitted by means of the smooth part of the screw from *s* to *t* (fig. 115). Through this permitted mobility manual movements of the part, valuable adjuncts to treatment, can be effected. These movements become more indispensable when the patient can be allowed to take exercise. To facilitate this object, the author contrived the adjusting-screw and quadrant represented fig. 119. Passive movements when seated, and active bending during exercise, can be effected by this arrangement to any extent. It is the simplest, least expensive, least liable to need repairs, of any of the contrivances he has seen. For adjusting straps, see fig. 114.

recommend mechanical means, but which, among the very poor, you will treat by tenotomy, as a means of expediting the recovery. It is unnecessary to discuss the relative merits of the two methods. Tenotomy is not appropriate to cases remediable by instruments. If you are in doubt, try the mechanical plan; but if, when the age of walking approaches, the patient is not sufficiently restored to permit the free application of the foot to the ground, and the performance of the natural movements, tenotomy should be no longer postponed, as the act of walking on the foot in an improper position for a single week will certainly aggravate the deformity. This remark applies as well to walking with the aid of "irons," into which instrument-makers place children in order to enable them to support themselves. If the effect of the "irons" is not to cause the child to tread quite evenly, they are worse than useless. They serve only to hide the increasing deformity.

[In the treatment of foot-deformities, other apparatus may be occasionally employed. Stromeyer's foot-board is ingeniously adapted to T. equinus, T. equino-varus, and equino-valgus (see figs. 116 and 117), and presents an important advantage for hospital practice, that it is inexpensive, and may serve for many patients in succession. In extreme congenital T. varus, the modification of Scarpa's shoe (fig. 118) is of utmost service. It is capable of adaptation to severest cases. The movement represented fig. 119 may be substituted for any of the contrivances enumerated. Its advantages consist in the freedom of movement of ankle in the desired direction permitted to the patient during the act of locomotion.]

As club-foot essentially depends on unnatural shortening of the muscles of the calf and of the anterior and posterior tibial muscles, you might, when, at any age, the operation is resolved upon, *à priori* conclude that section of each of these parts is indispensable. If tenotomy were resorted to simply as a means of removing the presumed spastic state of the muscles, if its *modus operandi* were

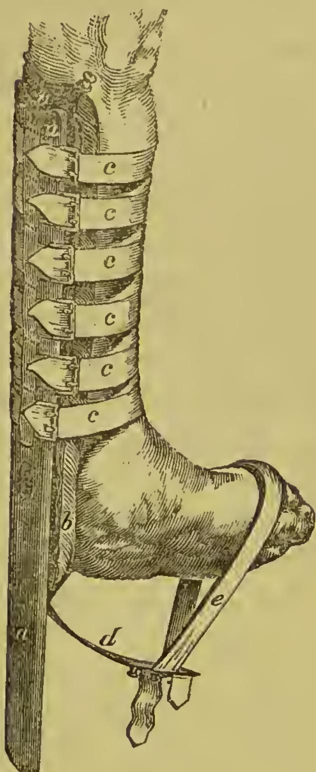
dynamic, it would follow that every muscle involved should be severed. But the operation is often requisite as a simple means of elongating a contracted cord; its effect is mechanical. It is difficult to determine in every case of T. varus whether spastic action of muscles, or mere structural shortening of their fibre, maintains the deformity. You may, therefore, *on principle*, determine to divide the largest of the tendons, that which by its anatomical arrangement offers the largest share of resistance,—the tendo-Achillis for example,—and complete the cure by mechanical elongation of remaining tissues. But if, in cases of average severity, you perceive that the anterior and posterior tibial are very tense, the fibres of the patient robust and unlikely to yield to mechanical treatment, you will determine to divide these also. In numerous instances the flexor muscles of the toes and the plantar fascia are conjointly affected, and consequently division of those within reach, the flexor longus pollicis, plantar fascia, or even the abductor pollicis, should be effected.* After every section many tissues remain for elongation by mechanical treatment.

The operative treatment of severe T. varus in youths and adults may be advantageously divided into two stages. Owing to the slowness of restoration in extreme cases (as at figs. 107, 105), the treatment often occupying six [to twelve] months, it is proper to divide, in the first instance, the tendons and other structures which adduct the foot, and devote attention to its eversion so as to reduce it to the condition of T. equinus, and subsequently to sever the tendo-Achillis and depress the heel; the object being, in the first instance, to reduce a complicated deformity to a more simple form. A common splint, bandaged on the outer side of the limb, often proves the best mechanism

* Mr. Martin Coates attributes to the plantar fascia and muscles too large a share in the maintenance of varus. His *Practical Observations on Talipes*, Salisbury, 1810, were particularly valuable, by shewing the advantage of severing the fascia in question.

for this purpose, or the splint (fig. 120) may be employed.

Fig. 120.



Splint occasionally applicable in the reduction of the severest grade of T. varus. The letters *a a* represent a strong wooden splint, having a circular hole at the part applied to the malleolus externus; *b b*, an india-rubber air-cushion, placed between the splint and the outer side of the leg. The straps with buckles marked *c* serve to secure the splint firmly against the limb; *d* is a steel spring, the power of which should depend on the strength of the ligaments and other tissues which it may be requisite to elongate; *e* is a padded strap passed around the front part of the foot, the lengthening or shortening of which diminishes or increases the traction exercised by the spring. The foot and leg should be bandaged, to prevent the occurrence of swelling.

The depression of the internal edge of the foot and of the heel can be effected by the apparatus (figs. 114, 118, 119). By these means the most severe congenital T. varus, in patients even of thirty years of age [and upwards], may be entirely removed. The after-development of muscles and acquisition of strength of limb may be facilitated by the general measures so often enumerated whilst speaking of other deformities.

[Several modes of dividing the posterior tibial tendon in T. varus have been proposed. Thus Stromeyer's plan is that described in these Lectures at p. 93. It is only applicable to adults, or to cases in which the tendon is prominently visible.

Weis* and Velpeau divide it at its insertion into the navicular bone, the knife being inserted so as to meet the tendon about an inch (in the adult) below and in front of the inner malleolus. To avoid wounding the plantar artery, it

* De Tenotomia Talipedibus applic. C. Weis: Havniæ, 1844; and *British and Foreign Medical Review*, vol. xxi. p. 171.

is recommended that the knife should not be carried further in during the section of the tendon than is absolutely necessary. This plan is equally inapplicable to infants.

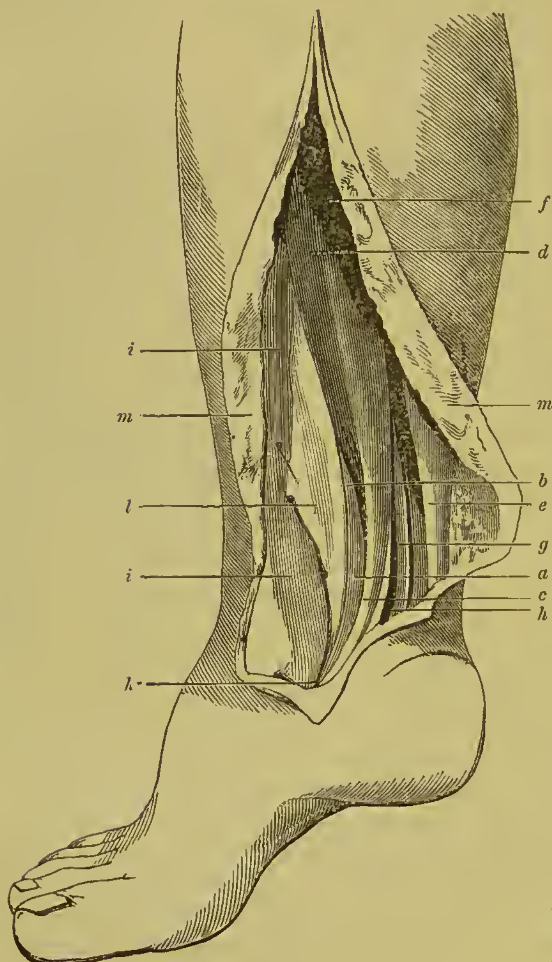
"Dr. Little's *plan for dividing posterior tibial tendon in the infant*."*—To perform this operation on the left foot, it is necessary that the little patient should be laid upon a

* The successful division of the posterior tibial tendon in the infant constitutes an important epoch in the history of tenotomy applied to the cure of varus. The above operation is acknowledged to fulfil the conditions of celerity and safety, and is now generally adopted in this country. By this method and by that of Stromeyer the long flexor is often at the same time divided, which constitutes an advantage.

At the period of publication of his *Treatise on Club-Foot*, &c. (1839), the author had only operated the posterior tibial in adolescents and adults, in whom it is visible or easily felt, by the method of Stromeyer. From this period to 1842 he was accustomed in children above the age of twelve months, from the difficulty of accurately feeling the outline of the tendon owing to relative fatness of legs compared with the size of the tendon, to expose the tendon by an incision in the integuments three quarters of an inch in length, and divide it upon a director. Having about this period witnessed suppuration in a limb ending fatally, in which a tendon had been severed after exposure, the author relinquished this departure from subcutaneous tenotomy. To meet the necessity of dealing with the posterior tibial tendon by tenotomy in the same manner as the anterior tibial and tendo-Achillis, all of which the author had from 1837 taught as coadjutors in production of varus—division of it by exposure in fat children being abandoned—his pupil and subsequent colleague Mr. Tamplin proposed to divide the posterior tibial by effecting a puncture into the sheath of the tendon with a stilette and canula; and after withdrawal of stilette, introducing through the canula a blunt-pointed knife. The idea of thus dividing the tendon from before backwards towards the artery was novel, but both unsuccessful and unsafe. After withdrawal of the stilette, the canula could not easily be held within the aperture made into the sheath, the blunt-pointed knife could not then be passed into the sheath, and in the act of plunging a stilette and canula from before backwards between the tendon and the tibia, there was risk of penetrating too deeply, and of inflicting a punctured wound upon the posterior tibial artery and nerve, or of transfixing the tendon itself. Mr. Tamplin, as well as the author, tried this proceeding two or three times, and was compelled to abandon it. The author perceived the weak points of that operation, and profited by the suggestion to divide the tendon from before backwards, rejected the stilette and canula, substituted a small scalpel for making an aperture into the sheath, and had the knife *b*, fig. 122, made by Ferguson, as an improvement upon the tenotome of Bouvier, with

table of convenient height, and that a competent nurse steady the arms and hold the right knee out of the way of the operator.

Fig. 121.



The annexed drawing represents the normal anatomy of the parts interested in this operation:—*a*, tendon of tibialis posticus passing behind the internal malleolus, and enclosed in its proper sheath; the line (*a*) corresponds to the point described as the proper place for its division; *b*, tendon of tibialis posticus appearing from beneath the flexor communis digitorum; *c*, tendon of flexor communis digitorum immediately behind tibialis posticus; *d*, origin of flexor communis digitorum from tibia; *e*, tendon-Achillis; *f*, origin of solæus from tibia; *g*, posterior tibial nerve midway between tendo-Achillis and flexor digitorum communis; *h*, posterior tibial artery close to the nerve; *i i*, tibia; *l* represents the fascia which covered the deep layer of muscles, but is now reflected forwards, and fastened to the tibia with a pin: the drawing shews its insertion into the edge of the tibia; *m*, layer of fat and skin reflected.

An assistant, having a few small dossils of lint, a

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which to divide the tendon, satisfied that if he should wound the posterior tibial artery, it would in all probability be by a division, and not by a puncture. Experience has justified this proceeding—that if the artery be entirely severed, the disposition of the divided ends to contract, aided by moderate pressure, prevents hæmorrhage or false aneurism. The author's method was first published in the *British and Foreign Medical Review*, 1844, vol. xxi.

bandage, and the necessary knives within reach, takes his place by the side of the patient and holds the thigh, whilst the operator, seated in front, endeavours to feel the slight prominence of the posterior tibial tendon with the thumb of the left hand, during the time he is either abducting the foot or inducing the child voluntarily to move the ankle-joint.

For all practical purposes, however, it is quite sufficient to make out the inner edge of the tibia, about a finger's breadth above the lower end of the inner malleolus; or should there be any difficulty in defining this ridge of bone in consequence of the fatness of the limb, the careful insertion of the knife *exactly midway between the anterior and posterior borders of the leg*, on its inner aspect, will be a true guide to the position of the tendon, not forgetting, as anatomy teaches us, that an incision made a little in front of this line might wound the internal saphena vein and nerve; and if made behind it, would run the risk of dividing the flexor communis digitorum instead of the tibialis posticus; or the knife might even pass posterior to the former tendon, and if carried deep enough, might wound the artery and nerve without touching any tendon whatever.

Having thus determined the exact situation of the posterior tibial by one or all of these methods, a sharp-pointed knife (as represented in fig. *a*) is passed through the skin at about a finger's breadth above the inner malleolus, according to the age of the child. It must be made to penetrate steadily down, perpendicularly to the surface, to a depth varying from a third to a quarter of an inch. In doing this, it is necessary to be quite sure of sufficiently opening the fascia covering the posterior tibial and common flexor tendons, otherwise when the probe-pointed knife is passed in (as will be described in the next stage of the operation), it may either hitch against this dense unyielding structure, or glide over its surface behind the deep

layer of muscles, instead of passing through the opening in front of them.

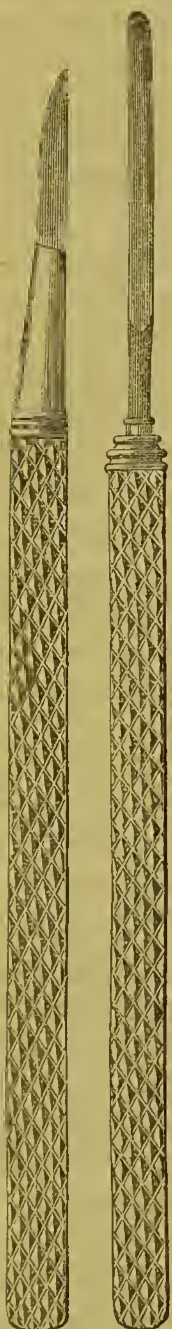
In order, therefore, to accomplish the *free division* of this fascia of the leg close to its insertion into the edge of the tibia, and likewise the more delicate and proper sheath of the posterior tibial tendon beneath, the sharp-pointed knife should be passed to the depth above recommended; the handle must then be elevated so as to depress the point of the blade; that is to say, the instrument should be used as a delicate lever, the centre of motion being the skin, which may be pressed upon gently by the back of the knife; and in this way an opening of the requisite size can be made in the fascia at the bottom of the wound, without the risk of enlarging the external aperture.

Having thus far accomplished the operation, the sharp-pointed knife is withdrawn, and a probe-pointed one (fig. *b*) is to be passed down the same track of wound through the skin, superficial fascia, layer of adipose tissue, deep fascia, and lastly the proper sheath of the tendon, and be now inserted a little further in, so as to get well between the posterior tibial and the tibia. When satisfied from the sensation communicated to the knife that the bone is on one side and the tendon on the other, all that remains to be done is to turn the edge towards the tendon, giving the knife a slight cutting motion, while at the same time the assistant firmly abducts and depresses the inner border of the foot.

A distinct sensation of something having suddenly yielded can be perceived at the time of the division of the tendon; but if the case should have been previously operated on, this feeling may be very slight in consequence of the adhesions existing between the original wound of the tendon and the adjacent parts.

As soon as this peculiar jerk is detected by the assistant, he should immediately relax the foot and apply a

Fig. 122.

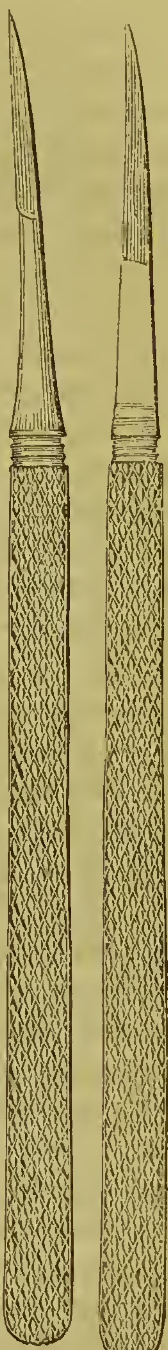


a b

small dossil of lint over the wound, holding it there with the forefinger during the division of any other tendons. If the artery is supposed to be cut, either from the sudden escape of florid blood, or from the marked blanched appearance of the foot, it will only be necessary to apply a graduated compress, and to roll firmly a figure-of-eight bandage upon the foot and ankle. This, however, may require to be loosened in a few hours if the colour of the toes shews any indication of strangulation. If the operator is not ambidexter, he will find, in the operation for dividing the posterior tibial tendon of the right limb, that he had better stand on the left side of the patient with his back to the patient's face, whilst the assistant sits down in front and holds the thigh with one hand while he steadies the toes with the other.

Taking, then, the mesial line or the inner aspect of the leg at about three-quarters of an inch above the inner malleolus as the true position of the tendon, the sharp-pointed knife is to be inserted with its back towards the sole of the

Fig. 123.



c d

foot. It is thus made to divide the skin and deep fascia in the same way as was explained when cutting the left posterior tibial tendon. After this instrument is withdrawn, the probe-pointed knife may now be used to finish the operation, which, in all other respects, agrees with the section of the corresponding tendon on the opposite side of the body.

Whilst these pages were passing through the press, repeated dissections of the ankle, in order to shew the relative position of the artery and nerve to the tendons about this part, suggested that the sharp-pointed knife (fig. *a*) might be passed to the necessary depth between the tendon and bone (as recommended in the first stage of Dr. Little's operation) ; and that by turning its edge the posterior and tibial tendon might easily and safely be divided during the abduction of the foot, thus reducing the operation from one *à deux temps* to a single proceeding. Trial of this method upon both feet (Extreme Varus), in an infant aged six weeks and in a boy aged seven, without wounding the artery, and with Dr. Little's confirmation of the fact, that he had never felt the posterior tibial tendons yield more readily, justifies the recommendation of this simplified operation to the notice of surgeons. (Gowlland.)

The division of the anterior tibial tendon in Talipes varus should follow the section of the posterior tibial ; the patient being in the same position, and the assistant still holding the limb, and pressing his finger upon the lint covering the puncture already made above the ankle. The operator should feel for the most prominent part of the tendon over the joint, somewhat nearer the malleolus than in the normal foot, and insert a sharp-pointed knife (fig. *c* or *d*), with its flat surface towards the tendon ; and having passed it well beneath, he should turn the sharp edge towards the tendon, whilst the forefinger of the left hand is pressed gently over the part, to warn him of the approach of the knife to the surface.

The assistant, who has been steadily abducting the foot during the operation, gradually relaxes his endeavours as he feels the tendon yield; and so soon as he perceives the distinct snap which is the result of its complete division, he should immediately relax his hold, and apply a small dossil of lint over the puncture. Division of T. Achillis in infantile varus is accomplished after turning the infant over on the abdomen as described p. 92.*

If the cases of congenital club-foot be classed under three grades, all those of the first or slightest grade may unquestionably, within a reasonable period, be cured by well-applied mechanical treatment. Many of the second grade will also yield to this method, although the treatment will necessarily be more tedious, perhaps scarcely completed when the time arrives at which healthy children usually walk alone, say twelve or fourteen months; whilst the whole of those of the severest grade can only be remedied, within a reasonable time, by operation. The author would not, after the observations at p. 283, return to this subject, if he did not believe that, however essential tenotomy is in the above proportion of cases of infantile club-foot, it is unnecessary in the remainder of the cases; for although the form of the member is by means of tenotomy more promptly remedied, the function of the divided muscles is often less completely restored. The author has witnessed many instances of congenital varus successfully treated without tenotomy, by others as well as by himself, in which the muscles of the calf attained almost the normal development; whereas after tenotomy the muscles usually remain much smaller than natural, and the calf disproportionably high. He is too sensible of the value of tenotomy pro-

* Mr. E. Weight, surgeon to the Wokingham Union, Berkshire, in describing (*Medical Gazette*, 1839) some interesting cases of Talipes operated by himself, has proposed to term tenotomy the Thilenian operation, in honour of Thilenius, who first determined to divide the tendo-Achillis as a therapeutic measure.

perly applied to disparage it; he desires only to offer an opinion that may stay the hands of an occasional over-zealous operator. Useless, *i. e.* unnecessary tenotomy weakens the muscular power of a limb which, without operation, might have attained the normal development; whereas, paradoxical as it may at first sight appear, the proper application of tenotomy, by enabling the attendant to effect a cure of a deformity proved by experience to be otherwise irremediable, prevents the occurrence of atrophy, which is the ordinary concomitant of uncured club-foot; nay more, in proper cases the operator has the satisfaction of witnessing a gradual augmentation of muscle. (*British and Foreign Med. Review*, vol. xxi. p. 176.)

The completeness of recovery in the great majority of the cases of congenital varus constitutes a perfect triumph of art. Even in stubborn cases during childhood, if the mechanical after-treatment be properly attended to, repetition of operation is rarely requisite. In the severest adult cases, owing to the length of time occupied by the mechanical treatment, it may be necessary to redivide the tendo-Achillis once or twice; but the more frequent repetition of operation effected by Dieffenbach and Phillips* is accounted for by the little attention directed to mechanical treatment by those authors.

During childhood congenital varus may be entirely cured, without other traces of deformity than smallness of the member, greater squareness of front of foot, and sometimes less complete mobility of ankle-joint, the patient recovering entire volition. When the case is unattended to before adult age, the internal margin of the foot may never be completely applied to the ground, owing to the impossibility in some cases of perfectly unfolding the os cuboides from its inferior and rotated position in the tarsus; in other instances, owing probably to the round head and neck of the astragalus having become so much inverted in relation

* De la Ténotomie sous-cutanée, Ch. Phillips: Paris, 1841.

to the remainder of the bone, that part of the undue convexity of the tarsus outwards becomes irremediable. Every year will doubtless reduce the number of adult cases of varus requiring treatment, so that the consideration of any means of meeting the attendant difficulties may appear superfluous. The author has usually found a most efficient agent in a firm pad placed in the sole beneath the os cuboides, by which means, during instrumental treatment, before and after locomotion is permitted, the principal pressure of the instrument is directed against the protruding bone. He has often thought that in inveterate varus, such as figs. 105 and 106, the treatment might well be commenced in robust subjects by ablation of the os cuboides, which, in preventing the unrolling of the foot, acts as the key-stone of the inverted arch. He is of opinion, that by this means the treatment of certain cases might be reduced from twelve months to six or eight weeks.

Age sets no limit to the applicability of tenotomy; the author has successfully treated adult varus at the age of forty, and non-congenital equino-varus at fifty-four.

As an absolute rule, after tenotomy no replacement of the part should be attempted until after the puncture has cicatrised; and as a general rule, no sudden or rapid replacement is proper until some days later. Much has been written respecting the propriety of immediate replacement. It is unnecessary in slight cases, and impossible in severe ones (see p. 168). In slight cases, nothing is gained by it; for if the position may be immediately rectified, the part cannot be immediately used. The part should, therefore, be gradually replaced whilst the tendon is consolidating without the smallest pain at the severed part.

Stromeyer has suggested, that previously to operation the patient should be accustomed to wear the replacing instrument. This plan is desirable when the practitioner is unfamiliar with the treatment of deformities; for he

thereby becomes versed in the action and mode of application of the apparatus, and is rendered certain beforehand of the appropriateness of the contrivance.

With reference to the choice of apparatus, Stromeyer has rightly remarked, that every practitioner will select that of which he best understands the action and mode of application. This sagacious observation explains also one cause of the zeal with which each writer advocates his particular appliance.

It cannot be too strongly insisted upon, that in a large number of deformities, whether treated with or without operation, expensive instruments are unnecessary. More depends upon the tact, patience, and perseverance of the practitioner than upon the apparatus employed. Common roller bandages, tin, wood, or gutta percha, may, in ingenious hands, supply the place of the most elaborate contrivances (see p. 31).

It may sometimes happen that no instrument is available, and the after-treatment require to be entirely conducted by manipulations. Thus an adolescent case of double congenital varus was admitted into the London Hospital, under the care of Mr. Critchett, which had been rejected as incurable from another hospital on account of large ulcers with necrosis of dorsum of each foot, induced by pressure during the mechanical treatment after tenotomy. As the unhealthy character of the ulcers depended upon want of air and exercise, and the application of suitable instruments was impossible, it was determined to repeat tenotomy, and effect forcible manipulations of the members. Chloroform was upon one occasion employed. By these means the feet were gradually straightened, cicatrisation of the ulcers was thereby favoured, and within three months the lad quitted the hospital.

After congenital varus, as after acquired deformities, retentive apparatus may be required : these for the most part consist of jointed irons to support weak articula-

tions, and springs to assist the action of debilitated muscles (see Appendix).

Congenital Calcaneo-varus.

A deformity which may be thus named is sometimes present at birth. It consists of the inversion of the toes, contraction and vertical position of the sole, and convexity of dorsum of varus, without the elevation of the heel which occurs in that deformity. Its cause is preponderating action of the anterior and posterior tibial muscles—through which the foot is thrown upon the outer margin—and of the plantar muscles, in consequence of which the hollowness of sole and convexity of dorsum are produced. Prominence of round head of astragalus exists through the navicular bone, and the front row of tarsal bones being drawn inwards and towards the sole.

The deformity is never very considerable; the author has only seen it in one foot at a time. In some instances the opposite member has been affected with ordinary varus. The treatment consists in the removal of the preponderant action of adductors and plantar structures by mechanical treatment or tenotomy, according to age and amount of deformity; the same rules for deciding being applicable here as in treatment of varus (p. 283). The result of treatment is less favourable than in ordinary varus. The instrument figs. 65 and 66 may be useful in these cases.

Ordinary varus is sometimes converted into a deformity resembling calcaneo-varus by division of tendo-Achillis and removal of heel-elevation, and omission to remedy the adduction and plantar contraction. For this reason it is desirable to remove the adduction of varus either simultaneously with, or even previously to, the relief of the contraction of gastrocnemii.* It is, moreover, easier

* Duval (opus cit.) has proposed entirely to alter the nomenclature of Talipes by terming ordinary varus Equino-varus, in consequence of elevation of heel entering into the constitution of varus. This substitution of a new

to remove the inversion of severe varus, and especially the contraction of the sole, before the tendo-Achillis has been divided; for the retracted gastrocnemii, when undivided, firmly hold the os calcis during the treatment directed to elongation of the sole (p. 295).]*

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term, although scientifically indicated, is not desirable in opposition to the usage of twenty centuries.

Duval considers that the distortion I have designated Calcaneo-varus alone merits the name of varus. As congenital Calcaneo-varus is an uncommon distortion, Duval would apply to it a designation universally given to the most common of distortions, through which confusion would occur. Less difficulty would arise from the adoption of his term Strephopodie (στρέφω, *to twist*), as a generic term for foot deviations. But even this designation is unnecessary, Talipes being now generally employed in Germany and England. Several French authors apply the term Kyllopodie (κυλλός, *bent inwards*) to varus.

* It may be remarked as a contribution to the etiology of congenital distortions, that the parents of children born with varus, for example, often present uncommon convexity of tarsus without contraction of leg-muscles, and without appreciable deformity, or they, and their fathers before them, have been particularly accustomed to turn-in their toes. They have what may be considered a small element of Calcaneo-varus or of varus, viz. unusual concavity of sole, probably due to some unusual tension of plantar muscles, or some undue tension of posterior leg-muscles. But in accordance with the observed law in physiological pathology, that parental derangement is reproduced in the progeny in increased intensity, unless counteracted by another law which regulates the union of the sexes, but which it is unnecessary to enter upon here; the child is born not simply with an affection dependent upon slight undue tension of plantar or other muscles (as in the parent), but presents increased disorder of nervous and muscular systems, severely involving muscles of the leg, as well as of the sole, and consequent varus. It cannot correctly be asserted, that the fact of well-marked distortions being hereditary is a proof of their dependence upon nervous and muscular systems, and not upon mechanical influences in utero; inasmuch as an hereditary tendency to abnormal size and site of the uterus, and consequent mechanical disturbance of embryo, may be supposed to exist.

The fact of augmentation of diseased action in succeeding generations speaks more for the origin of deformities within the embryo.

LECTURE XVI.

Congenital distortions (continued)—*Congenital Talipes valgus—T. equino-valgus—T. calcaneo-valgus—Treatment of these deformities—Universal congenital distortion of the lower extremities—Congenital paralysis of the lower extremities—Congenital luxations—Congenital distortions of the upper extremity—Club-hand—Valgoid deformity of hand—Congenital wry-neck—Congenital deformity of the spinal column—Congenital hypertrophy of muscles and other parts—*Malformations—*Classification.*

TALIPES valgus is a much more rare affection than T. varus. It may be regarded as the opposite state, and, like

Fig. 124.

Front view of a congenital Talipes valgus of the right foot of a boy aged four years. *d a*, the outer edge of the foot raised from the ground; *e*, the great toe raised from the ground, although the internal edge of the foot is directed towards it; *b*, the internal malleolus; and *c*, the internal extremity of the navicular bone, being the parts upon which the patient walked.*

* When slight congenital valgus is not discovered until the child begins to walk, it may be confounded with slight rachitic or spurious valgus. If not distinguishable by other signs, the existence of contraction, or deformity of the great toe, will shew the case to be true valgus (from muscular contraction).

it, consists of a threefold alteration of the position of the foot; partial bending of the ankle, *ab*duction, and a rotation of the foot exist; but the rotation takes place in the opposite direction to that in Talipes varus, as in T. valgus the external *edge* of the foot is removed from the ground. The rotation in a complete case of T. valgus is so great, that the patient in the act of walking does not touch the ground with any part of the sole of the foot, but treads entirely upon the inside of the instep and upon the malleolus internus, as in this model (fig. 124). In short, the sole of the foot is directed completely outwards and a little backwards, the ankle is held in a state of semiflexion, the anterior half of the foot (the metatarsus and toes) not touching the ground.

A result of the destruction of the equilibrium of the muscles of the foot, through the tension of the peronei, is to expose the yielding tarsus of the infant to be bent between the opposing anterior muscles of the leg and those of the calf (see p. 170).* So long as the astragalus is properly acted upon by the gastrocnemii and anterior muscles

Fig. 125.

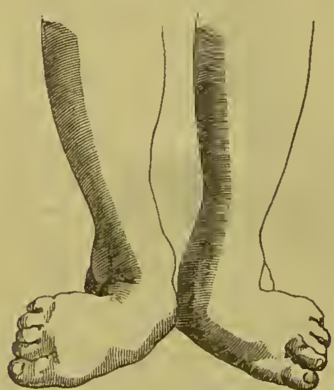
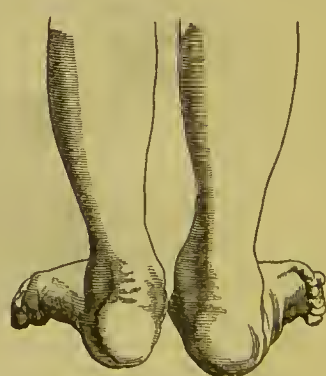


Fig. 126.



Anterior and posterior views of congenital valgus, in an infant three weeks old; the position being entirely due to muscular action, the subject not having walked.

* Congenital varus is sometimes converted into a valgoid deformity through the injudicious use of mechanical means. The position of the toes is changed from inversion to eversion; but as the tendo-Achillis does not yield, the tarsus bends in the middle, as already described, valgus taking the place of varus.

of the leg, these muscles mutually balance in their action ; but when, through the unnatural tension of the peronei, the natural movements of the ankle are suspended, the tarsus yields in the middle, both extremities of the foot are elevated, the most inferior part of the tarsus being the navicular bone.

Three opportunities only of anatomically examining valgus have been presented to me. The subjects from which the preparations were taken were full-grown fœtuses. In these, so far as the incomplete development of the osseous structures enabled me to judge, the astragalus was twisted in such a manner that the articular facet, which ought to have been applied against the internal malleolus, did not enter into the composition of the ankle-joint, but was turned downwards; the navicular bone and calcaneum followed the astragalus, and, together with the internal malleolus, would have touched the ground by their internal surface. The external edge of the os cuboides, and fifth metatarsal bone, and external surface of calcaneum, presented directly upwards; the latter, therefore, was in contact with the external malleolus. The extremity of this process could not be felt.

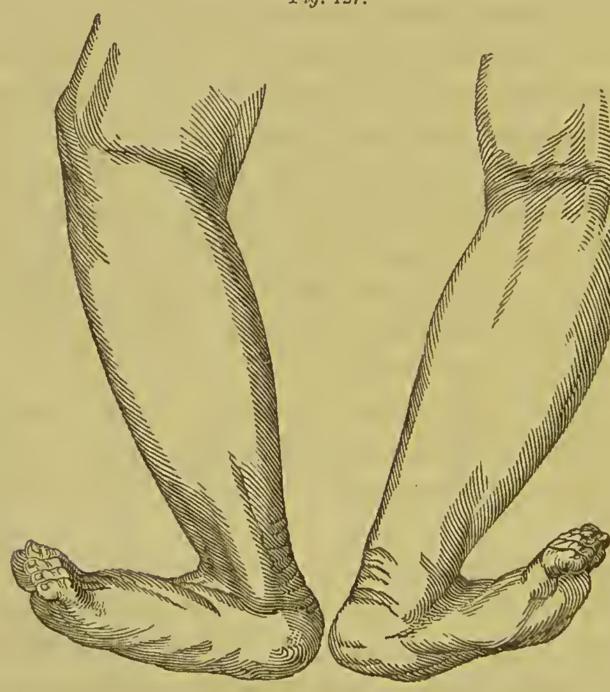
The peronei tendons, and the long extensor tendons of the toes, constitute the principal obstacle to restoration ; the tendo-Achillis is tense, and deflected outwardly through the rotation of the os calcis.

Talipes equino-valgus.—This congenital deformity is not very common : it precisely resembles, as respects external form, the non-congenital T. equino-valgus, arising from articular disease, or from paralysis of the anterior tibial muscle (see fig. 68, p. 169). If models of the same deformity from paralysis and articular disease be compared with those of which the origin is congenital, the identity of form will at once be recognised. These congenital deformities may often be successfully treated by mechanical applications; they sometimes resist this plan, and you may be compelled to have recourse to tenotomy, as in T. varus.

It is unnecessary to repeat here the circumstances that may render the operation indispensable. It is only necessary to remark, that the tissues requiring section may be the peronei, the extensor longus digitorum, and the tendo-Achillis. The same apparatus recommended for club-foot may be in these cases employed, with this important difference, that as the object will be to induce inversion of the toes, and depression of the outer edge of the foot, the springs should be applied on the inside of the limb.

Another congenital distortion of the lower extremity is T. calcaneo-valgus. In this affection (see fig. 127) the

Fig. 127.

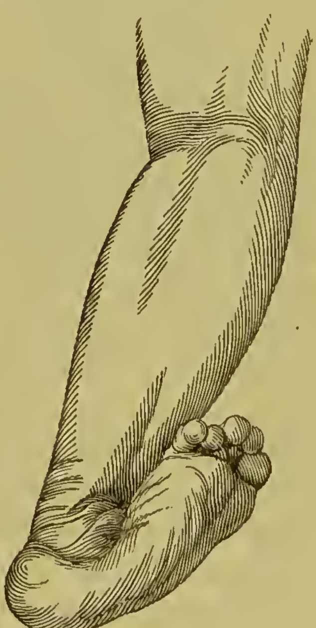


Congenital Talipes calcaneo-valgus in an infant a few weeks after birth.

front part of the foot is elevated and abducted, through the contraction of the peronei and extensor longus digitorum being combined with contraction of the anterior tibial and extensor proprius pollicis muscles. As no contraction of the gastrocnemii occurs in this deformity, the heel is depressed. The extensors of the knee may be

conjointly contracted, the movements of the articulation impeded, and the patella imperfectly developed. This deformity offers greater probability of cure by mechanical means than either of the preceding congenital distortions, as the powerful gastrocnemii assist by their action the replacement of the foot; nevertheless I have been compelled to employ tenotomy, and thus remove the resistance of the peronei and the anterior muscles of the ankle. It is more often possible to dispense with section of the latter than of the former muscles. The apparatus recommended in valgus is applicable in this deformity. This congenital deformity essentially differs from the corresponding contracture (non-congenital) by the absence of paralysis of the gastrocnemii (see p. 160).

Fig. 128.



T. calcaneo-valgus at the period of birth.

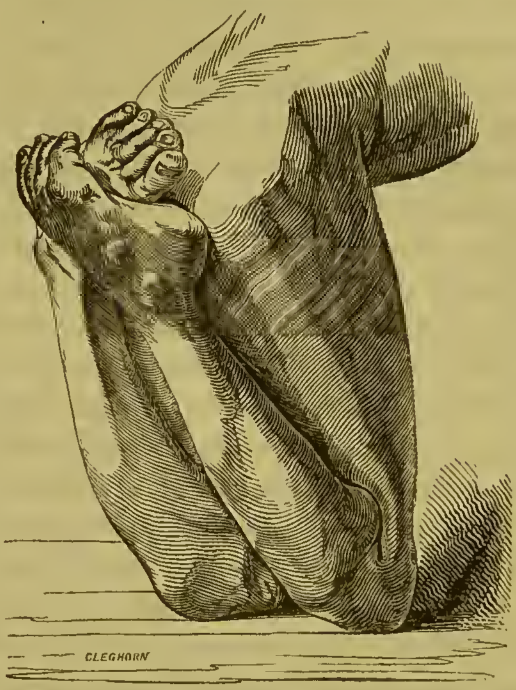
[It will be remembered that although the author has attributed congenital distortions, in general, to deranged muscular action, yet he has admitted the probability that causes, similar to all of those which act after birth, may act within the uterus. A glance at the representation of congenital valgus, figs. 125 and 126, will convince the reader of the difficulty of explaining the origin of a deformity of that particular form in both feet from any other influence than that assigned, viz.—perverted muscular action—tonic or spastic contraction. The subject of figs. 125 and 126 was the same at the moment of birth, as when three weeks later the drawing was taken. The same impression, with respect to etiological influences, might be conveyed on an examination of fig. 127; but an examination

of fig. 128, which represents one of the same feet, fig. 127, as seen at the moment of birth, impresses the observer with the conviction that so considerable an eversion of the outer margin, and approximation of the little toe and front part of the foot to the leg, could scarcely be primarily effected solely by muscular action. This deformity has more than any other served to convince the author that, besides distortions from muscular action, some congenital distortions may be produced by pressure of some kind in utero. Perhaps in this instance the etiological cause was impaction of a large child in a restricted space, the long mechanical retention of the part in an abnormal position having induced secondary preponderant action of the abductors and anterior muscles of the ankle.]

General congenital distortion of the articulations of the lower extremities occasionally occurs, and greatly resembles the universal non-congenital contractures formerly described (see Lectures VIII. and IX.). The principal difference between them is, that when congenital the general development of the limbs is more impaired, the distortion of the foot represents a more complete T. varus, and is more frequently associated with distortion of the upper extremity and wry-neck. I have witnessed many cases of this nature. In two, unusually interesting, the children were born with double T. varus, the knees rigidly flexed to so great an extent that the feet were applied one over the other against the nates. Abduction of the thighs was impracticable: locomotion was impossible. The patients always rested on the nates, the limbs remaining doubled beneath this part (see fig. 129). When the universal congenital distortion of the lower extremities is less severe, the patient may, at different ages, be presented to you, with the account that he has never walked, or that locomotion has been effected with great difficulty and lameness. You find on examination, the heels retracted, as in T. equinus or in T. equino-varus; the knees flexed to a right

angle; the thighs incapable of abduction, and flexed upon the abdomen, with great hollowness of the loins. Volition exists in the contracted and uncontracted muscles, within the range of motion permitted by the organic or structural shortening of the parts. Remembering the etiology of these cases, and comparing that with the actual state of the parts, you determine that the liberation of the contracted parts, as far as possible, by tenotomy and mechanical elongation, will place the members in a favourable condition for the exercise of volition and acquisition of strength. Experience has amply demonstrated the accuracy of the theoretic views formed concerning the pathology of such cases. These individuals may be enabled to walk in great comfort, although the primary injurious influence exercised through the nervous system on the muscles, and the atrophy arising from the long-continued abeyance of function during childhood, prevent complete re-establishment. Many such persons, who had never walked, have been relieved by me to the extent of fulfilling many of the ordinary engagements of civilised life. In some cases of this nature the amount of facility of locomotion obtainable is less than in others, in consequence of luxation of one or both hip-joints caused by the incessant action of the flexor and adductor

Fig. 129.



General congenital distortion of the lower extremities. At birth the knees were firmly drawn to the abdomen.

muscles. This constitutes one of the forms in which *congenital luxation of the hip* occurs. An equally common cause is congenital paralysis* of the whole or one set of the muscles of the hip. Whether the equilibrium of the muscles of the hip be destroyed by inordinate action or by deficiency in one set, the remaining parts of the articulation, the bones and ligaments, are imperfectly developed; hence the spontaneous luxation, as it is termed. In truth, as you will now understand, no essential pathological difference exists between congenital luxations and those which occur from altered muscular action after birth. The practical difference arises from the earliness of the period at which the congenital disturbance arises, and the consequent adaptation during growth of the parts of the articulations to the altered relations which they bear to one another. The acetabulum and the head and neck of the femur particularly suffer in their development.

[The intimate knowledge of congenital luxations possessed in the present day (1853) has been derived from the study of the anatomy of the subject in fœtuses, as well as from examination of the symptoms presented by these affections at shorter or longer periods after birth. Congenital luxations or sub-luxations, the latter being more common than the former, often occur in many articulations at the same time in the same fœtus, often symmetrical on both sides. They are common in fœtuses which have sustained evident derangement of nervous centres (acephala, hemicephala); in short the etiological influences of congenital luxation and of the common congenital distortion, club-foot, are the same. The difference probably being, that whilst the disturbance of nervous and

* The existeuce of congenital paralysis has been doubted. Since the above was written the author has seen several cases. For example, he has at present under treatment a young lady unquestionably born with distortion of hands, arms, and legs. Mobility of lower extremities has been acquired, but incomplete power of adduction of one thigh and total paralysis of adductors of the other thigh exists.

muscular system is in the one instance adequate to produce only a certain amount of contraction of certain muscles and deformity through the articular surfaces remaining in contact, the distortion is not much greater than that which may be produced in voluntary action upon the part (club-foot, club-hand); whilst in the other instance, either from the disturbing cause acting at a very early period of uterine existence, before the distinct formation of articular ligaments and cavities, the part is not only abnormally moved, flexed, or extended, as the case may be, to the utmost limit of voluntary action, or even beyond it, but the articular surfaces become positively luxated. As might be expected, the structural shortening of muscles, ligaments, and skin, and atrophy or arrested development of bones, and of the organs generally, reaches a higher grade in luxations than in the more common congenital distortions.

Of all the congenital luxations or sub-luxations, that of the hip is the most frequent; but almost all the articulations may be enumerated as subject to this condition; perhaps the order of relative frequency in the larger joints is the hip, knee, wrist, elbow, and shoulder. In order to constitute a perfect analogy between the lower and upper extremities, the corresponding joints should be affected with the same relative frequency. But the anatomical form of certain joints, according to circumstances, impedes or favours displacement. Thus the comparatively firmly packed articular surfaces of the astragalus permits distortion (club-foot), but not luxation; whilst the slightly articulated carpus is, before birth, more often sub-luxated than merely contracted.]

It is unnecessary to detain you with a detailed consideration of the special operation applied [by M. Guerin]* for relief of congenital hip-luxation. It rests upon insuf-

* Guerin's elaborate and valuable *Recherches sur les Luxations congénitales:* Paris, 1841, conclusively brings congenital luxations into the category of distortions produced by intra-uterine abnormal muscular action.

ficient [or a too sanguine] application of the pathology of the subject; and tenotomy, in this instance, has suffered the abuse of most useful remedies, that of having been somewhat indiscriminately employed.

The treatment of universal congenital deformity of the lower extremities [with or without luxation or sub-luxation] should be conducted on the principles of the treatment of congenital T. varus. Section of gastrocnemii, adductors of the feet, the ham-strings, the adductor longus and brevis femoris, pectineus, rectus femoris, tensor vaginæ femoris, may, in suitable cases, be successfully performed. The remainder of the resistance to the movements of the articulations may be overcome by mechanical appliances. I cannot dismiss this part of my subject without alluding to the greater improbability of cure of congenital paralysis than of congenital spastic deformity. I have never witnessed the recovery of power in muscles paralysed before birth. Several of such cases have been four or five years [ten to fifteen (1853)] under my observation without amendment. This accords with pathological observation, that paralysis results from a higher degree of disorder and disease in the nervous tissue than spastic or irregular muscular action.

[The symptoms of congenital luxations or sub-luxations are very similar to those of the displacements which occur from articular disease (p. 66). The history—the co-existence of other congenital deformities—sometimes the existence of the luxation on both sides*—and the greater atrophy and deformity of congenital cases distinguish them from the non-congenital affections. Some congenital luxations rarely find their representatives in acquired luxations. Of these the luxation of the tibia forwards (fig. 131) is an example.†

* The existence of luxation of both hips is not an absolute proof of congenital origin. The author described in his *Treatise on Ankylosis* a case of double ankylosis from disease during the last stage of scarlet fever. Double luxation may also occur from accident.

† F. Adams, LL.D., the learned commentator on Hippocrates (Sydenham

The slighter forms of congenital sub-luxation are scarcely more than ordinary contractures; thus fig. 130 represents one of the knees of fig. 129, extended as far as possible by manual stretching. The shortening of ham-string muscles, the deficiency and tension of tegumentary structures, and the partial displacement of head of tibia into popliteal region, are evident.

Fig. 130.

Congenital sub-luxations of tibia backwards. Shortening of ham-string muscles and gastrocnemii. The prominence visible on the instep was produced by attrition against the ground in attempts to effect locomotion upon nates, see fig. 129; and compare the non-congenital similar paralytic affection, fig. 52, p. 151.

Sometimes the leg is at the same time rotated outwardly, corresponding with this condition in false ankylosis of knee (figs. 10 and 13).

Congenital luxation of knee, in which the tibia is drawn forwards on the anterior surface of the condyles of the femur, is a remarkable and interesting congenital deformity. The knee is incapable of proper flexion; on the contrary, the leg is bent towards the front of the thigh, instead of towards its posterior surface (see fig. 131). The quadriceps femoris is tense and shortened, and prevents replacement; and even the gracilis and sartorius, instead of assisting ordinary flexion, tend to approximate the front of the leg to the anterior surface of the thigh. Even in this abnormal

Soc. transl. of Hippocrates, vol. ii. p. 496) describes an interesting case of accidental dislocation of the bones of the leg forwards upon the femur. Reduction was easily affected.

position the biceps femoris asserts its influential presence, by giving to the knee a certain degree of inversion. The infant is sometimes said to have been born with the feet one on each side of the neck.

Fig. 131.

Congenital luxation of tibia forwards and upwards, originally incomplete in right limb, complete in the left. The drawing accurately represents the appearance of the parts uncovered from the umbilicus downwards. The thighs ludicrously look as if invested with short pantaloons; and the flexure of the knee in front, so unlike the normal arrangement, reminds the observer of the articulation of the claws of the common crab. The drawing represents the parts partially replaced by the hand, for the purpose of shewing the front of the thighs.

The author, in every case which has come under his observation, has effected replacement by gentle and continued mechanical treatment, and enabled the patient, by means of mechanical support, to walk well.

No doubt can exist that, by continuance of this treatment and attention to manipulations, the patient on reaching adult age will be free from deformity, and dispense with mechanical aid. Absence of patella has been erroneously suspected in these cases.]

Congenital *distortion* of the upper extremity is comparatively rare. I do not remember having witnessed it in the shoulder* [of living subjects]. It occurs in the form of abnormal flexion of the elbow. The wrist and fingers are the most frequently affected. It occurs in several grades; sometimes the development of the extremity is not generally impaired. This constitutes club-hand, the position of the member and the parts contracted being analogous to those of club-foot, T. varus. In so-called club-hand—a term which should be banished from scientific use—the pronators and flexors of the wrist and fingers are contracted. Cases of this nature

* The majority of cases of supposed congenital luxation of shoulder brought under the author's notice have appeared to be the result of infantile paralysis, displacement from weight of arm, and consequent atrophy.

admit of great relief. When slight, mechanical means may entirely effect a cure, because an equal disparity between the power of the flexors and extensors of the upper, as between the extensors and flexors of the lower extremity does not exist. The favour shewn the weaker muscles of the arm by the application of a splint during the growth of the member enables them to recover their just influence; and although, if the right hand alone be affected at birth, the individual may grow up left-handed, no distortion will remain in the weaker limb. When the case remains uncured throughout infancy and childhood, tenotomy may be required. Section of pronator radii teres, flexor carpi ulnaris, and of the palmaris longus, may suffice; sometimes, however, the flexor sublimis, and especially the flexor longus pollicis require division. This congenital distortion is more tractable than the corresponding *contracture* (see p. 154). Sometimes the distortion is more considerable, the ulnar side of the carpus, metacarpus, and little finger, being in contact with the ulnar side of the arm; sometimes combined with absence of one or more fingers. From our knowledge of the pathology of distortions of the lower extremities, resulting from the greater opportunities of observation, we should infer that as in that situation as many forms of congenital distortion occur as there are natural movements of the parts, so in the upper extremity the same pathological fact should present itself. I have hitherto described the analogue in the upper extremity to club-foot, viz. club-hand, and long expected that, from analogy, I should some day meet, in the upper extremity, with a distortion analogous to Talipes valgus. I have not been disappointed; here is a model in which the radial side of the hand is rigidly approximated to the radius. Like T. valgus in the lower extremity, this *valgoid* distortion of the wrist is more frequently than club-hand associated with actual *malformation* of parts. See Malformations (figs. 132, 140).

[Fig. 132 is an example of congenital sub-luxation of wrist forwards and outwards. The case having reached adult age without attempts at replacement, the infirmity was considered irremediable, although a suitable mechanical contrivance effected much improvement in position, and obviated much of the deformity. The patient had acquired very good use of the member.]

Fig. 132.

Congenital sub-luxation of wrist forwards and outwards from muscular contraction, causing deficient development of inferior extremity of radius. Possibly a less advanced stage of the malformation represented fig. 140.

Congenital wry-neck occurs combined with other congenital distortions, or singly. Its symptoms and treatment correspond with the non-congenital corresponding deformity. It yields to treatment more readily than the non-congenital spastic or paralytic forms (pp. 120, 137, 191).

[An affection of the neck occurs, in which, without disproportionate size of head (as in hydrocephalus), a general laxity of the part exists; the head falls in every direction (as in the new-born infant) long after birth, apparently from absence of volition, or more properly paralysis. It is probably sometimes congenital, but oftener a neo-natal affection. See note, p. 122.

Division of the sterno-mastoid should be effected near its origin, and requires the patient to rotate the head forcibly towards the opposite side, in order to render more prominent the contracted portion of the muscle. A sharp-pointed knife (*c*, p. 301) is introduced through the integuments, about half an inch above the clavicle, with its flat surface close upon the inner or outer edge of the muscle, according to the side of the neck to be operated upon. When the knife has gained the posterior surface of the contracted part, it may either be withdrawn, and a probe-pointed knife substituted; or if the border of the

sterno-mastoid is very prominent, the operator may, in

Fig. 133.

Congenital wry-neck from structural shortening of both sternal and clavicular portion of sterno-mastoid muscle. Compare non-congenital affection, pp. 107, 119.

some cases, venture to pass the former instrument *close* behind it; and when it has penetrated to the requisite

Fig. 134.

Restored case of congenital wry-neck.

extent, it may be made to finish the operation by turning its edge towards the contracted muscle.

In a fat subject, however, it will be better, after making the necessary puncture through the skin and fascia surrounding the muscle, to pass the probe-pointed knife behind it, so that the possibility of wounding the subclavian vein or transversalis colli artery may be avoided.]*

The second subdivision of congenital deformities is composed of *malformations*. From the description I have given you of the first subdivision, namely, congenital *distortions*, you are aware that, however great the distortion of parts may be, to whatever extent the parts may be drawn from their natural position by the active agents, the muscles, no [essential] alteration in the form of the individual parts, no deficiency, absence, or excess of parts, exists. It is true that with the continuance of deformity the muscles adapt themselves to the altered relation of parts, and become shortened, that the development of one part may be impeded by the position of the member; but these constitute only secondary phenomena.

The subject of *malformations* is one of great interest in a pathological point of view; but the distinctive character of the class being that of abnormal alteration of form, from excess, deficiency, or aberration of parts, it follows that they are less susceptible of remedy; indeed they are, for the most part, irremediable. From this cate-

* Since the printing of p. 191, the author has been favoured by Mr. Brodhurst with the following description of an ingenious instrument, which he has devised for the replacement of wry-neck: — "It consists of a framework of iron, which passes over the sternum and scapulæ, and rests upon the shoulders. To this frame an upright piece is attached, which reaches to the atlas, provided with three joints, moveable with cog-wheels. The first of these has a forward and backward movement, to move the head from the sternum; the second, a lateral movement to stretch the muscle on either side; and the third opens and shuts a pair of blades, which grasp the lower jaw and fix the head." He has tried it successfully in an unequivocal congenital case. Mr. Brodhurst has also made some interesting observations on the pathology of non-congenital torticollis.

gory we must except those which consist of unnatural fissures, as harelip and hypospadias, curable by the *plastic* art, imperforate states of mucous passages, as of the anus and vagina, sometimes remediable by an artificial opening; those instances of excess in which, as in the fingers or toes, the superfluous part is removed by the technical process of ablation.

Many malformations, from their extent and severity, are termed *monstrosities*, and but little of *practical* value can be said concerning them.

[The pathological anatomists usually classify all congenital deviations from the normal form under the head of malformations. In these Lectures the author has considered them under separate heads, because the idea of malformation tends to suggest that of incurability, and because a congenital *distortion*, except in etiological relation, has little in common with a malformation or monstrosity.

The following is the order of relationship of the different congenital deformities, according to the amount of departure from the normal form and the severity and duration of producing cause: Distortions, luxations, malformations, monstrosities.]*

* Subjoined is Henle's classification of malformations (Sömmering, v. Baue d. menschl. Körpers, viii. 1).

Class I. Malformations in which one or more parts are either too small or altogether wanting. Monstra deficientia.

Order 1. Parts wholly deficient.

a. Amorphus (Anideus, *a* priv., εἶδος, *form*).

b. Consisting of a more or less rudimentary trunk.

c. Deficiency of inferior half of the body (Acormus).

d. Deficiency of superior half of the body (Acephalus).

e. Rudimentary head and spinal cord (Perocephalus, Paracephalus, Pseudacephalus, Anencephalus, Hemicephalus, Microcephalus, Spina bifida, Nosencephalus (*νόσος*, *disease*), Thlipsencephalus (θλῖψις, *pressure, crushing*), Derencephalus (δέρη, *the neck, want of brain and upper part of spinal cord*), Deficiency of face (Aprosopus, Microprosopus).

I have met with a singular congenital deformity of the upper extremity, to which I may briefly draw your attention. Here are models (*exhibiting them*) of the upper ex-

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f. Very general malformation (Perosomus).
g. Trunk defective, members perfect (Perocormus).
h. Limbs defective, head and trunk present, perfect or defective (Peromelus, Gurlt; Ectromeles, Geoffr. St. Hil., εκτρωεῖν, *to cause abortion*); Phocomeles, φώκη, *a seal*, hands and feet being inserted immediately into the trunk; (Hemimeles, Ectromeles, Ectrodactylie).

Order 2. Dwarfed formations.
a. Nanosomus (νάνος, *a dwarf*).
b. Nanocephalus.
c. Nanocormus.
d. Nanomelus.

Class II. Coalitio partium. Symphysis.

Order 1. Fusion of the head.
a. Cyclopia, Monophthalmus.
b. Fusion principally of the lower half of the face (Monotia, Agnathus, Otocephalus. See Geoffroy St. Hil. for subdiv.).

Order 2. Fusion of the inferior half of the body, lower extremities (Syren formation. Monopodia. Sympodia). Symeles, the legs and feet being fused together, but otherwise perfect. Uromeles, legs fused, single foot. Sirenomoles, legs fused without distinct foot.

Order 3. Fusion of fingers and toes (Syndactylus, Gurlt).

Class III. Malformation from fissure; often connected with protrusion of neighbouring contained organs from the fissured part, sometimes consist of unclosed apertures.

Order 1. Head-fissures (Schistocephalus, Gurlt; σχιστός, *cleft*).
a. Fissure of cranium (related to Hemicephalus and Hydrencephalocele, Otto; undoubtedly due to Hydrocephalus).
b. Fissures in the face, of the whole, or of the nose, upper lip, or palate (Labium leporinum, Rictus lupinus); due to arrested development (caused by muscular retraction, Stromeyer).
c. Fissures of individual parts of face: tuba Eustachii, tympanum, tongue, iris, choroid.

Order 2. Fissures in the neck or trunk (Schistocormus).
a. In the neck (Fistula colli congenita), the remains of the bronchial openings (the author has seen a case of this description, less well marked than those described by Ascherson in 1832).
b. In the vertebral column (Spina bifida, from Hydrorachis).

tremities of a young woman. The right is perfectly symmetrical and feminine, the left considerably above the normal size, resembling more the limb of a blacksmith.

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c. In the thorax and abdomen (fissura sterni, hernia pectoralis, Ectopia cordis, Exomphalos, Prolapsus or inversio vesicæ urinariæ (see Geoff. St. Hil. for further subdiv.).

d. In the urethra (Hypospadias, Epispadias).

Order 3. Internal fissures in lungs, spleen, liver, thymus, kidneys, ab normal patency of ductus ven. arantii, duct. art. Botalli, foramen ovale.

Class IV. Abnormal closure of openings, Atresia (*ἄτρητος, imperforate*).

Order 1. Atretocephalus (Gurlt). Congenital closure of mouth, nostrils meatus audit. ext., eyelids, pupils.

„ 2. Atretocormus (Gurlt). Congenital closure of anus, urethra, vagina, often combined with malformation of intestine, uterus, &c.

Class V. Monstra abundantia.

Order 1. Of the whole body, the separate parts being more or less well proportioned ; *e. g.* giants ; also the condition of Polysarcia. The majority of this order scarcely belong to malformations.

„ 2. One or more parts are in excess, either from fusion of two germs, or more probably the cleaving asunder of a single germ.

a. Supernumerary parts, the head and trunk being single, ossa Wormiana, double cranial bones, maxillæ, tongue, teeth, coccyx, ribs, muscles, fingers, and toes.

b. Supernumerary parts, head or trunk double or manifold (Monstra duplicia, bigemina, trigemina,) through fusion or implantation (Diprosopus, Dicephalus, Didymus, Symphyo-thoraco-gastrius Hetero-didymus, &c.

Class VI. Situs mutatus.

Order 1. Of the heart, spleen, liver, intestine, &c.

„ 2. Of the course of blood-vessels, &c.)

„ 3. Of the change in situation of bones, congen. curv. of verteb., club-foot, club-hand from abnormal muscular contraction during fœtal existence.

Class VII. Hermaphroditismus.

Besides these classes are those pathological changes during fœtal life which are not included amongst malformations ; also the changes which the fœtus undergoes in extra-uterine fœtation (Lithopädion), and the diseased conditions of placenta and fœtal membranes.

These Lectures shew that many fœtal conditions, included even by Henle in the category of malformations, are through extended research brought into the class of fœtal diseases.

The left clavicle and scapula correspond with the abnormally large arm and hand. In infancy she was observed to possess power of raising greater weights with the left than the right; but at the same time it was noticed that she did not possess equal flexibility of the member. Contraction of the flexor and pronator muscles has gradually increased, the movements effected by them being limited. The elbow was rigidly bent about forty-five degrees. But the peculiarity consisted in a hardness as well as hypertrophy of the contracted muscles, viz. the biceps, and the two masses of muscles arising from the condyles. The tension of the pronators preponderated.

As the functions of the member were daily becoming more limited, I effected tenotomy, by which, with some difficulty, the limb was straightened, and in a few months the functions were restored. A *tendency* to recontraction existed; this was obviated by attention to daily manipulation and use of the member. The hardness of the muscles in this case exceeded the cartilaginous hardness and hypertrophy sometimes observable in congenital wry-neck.

It is unnecessary longer to dwell upon this matter, but refer to some remarks connected with it in the second lecture. The ancient explanation of such a case would have been that the nisus formativus was in excess; but this is the mere statement of a fact, and no explanation.

A frequent malformation exists either alone or combined with *distortion*, which, as it may be partially remedied, so as to render the member serviceable for many of the ordinary purposes of life, may be here described. It consists of congenital atrophy of the leg and foot, with malformation of the leg-bones. These appear to be fused, so as in reality to consist of one bone only, presenting a considerable curvature, anteriorly, as in the right limb of this model (fig. 135). The deficiency of fibula is more apparent inferiorly, where no malleolus externus is perceptible. Certain muscles, which are rudimentary, are con-

tracted, the gastrocnemii and the peronei ; the foot is consequently everted, as in T. valgus, and usually two or three toes are deficient. At the most projecting part of the curvature of the bone a dimple-like depression of the skin exists, the integument being there more adherent to the bone than elsewhere, reminding the observer of the cicatrix and prominence of tibia after bad union of a compound fracture. Considering that this *malformation* is often combined with *distortion* in other parts of the body, as in the left foot of the model before you (fig. 135), and that muscular contraction exists in the seat of the *malformation*, I am of opinion that the origin of the *malformation* was similar to that of the *distortion;* that through disorder of the nervous centres both limbs were affected with inordinate muscular action ; that in the right the convulsions of the member may have been so considerable, and have occurred at so early a period of intra-uterine existence, as to have occasioned mechanical injury and fusion, if not fracture, of the tender bones, destruction of some of the metatarsals and corresponding toes.* It is worthy of remark, in corroboration of this hypothesis, that the deficiency of toes is on the peroneal side of the member, in this model the fourth and fifth being absent. The parts that have suffered are more nearly in relation to the peroneal nerve. As the left foot

Fig. 135.

Fusion of right tibia and fibula, probable *intra-uterine fracture of leg-bones, deficiency of toes. Valgoid foot.*

* Or the malformation may simply be termed defective development through disturbance of nervous centres.

is not affected with the highest grade of T. varus, and little atrophy exists, I am of opinion that the affection of this member was subsequent. The most interesting cir-

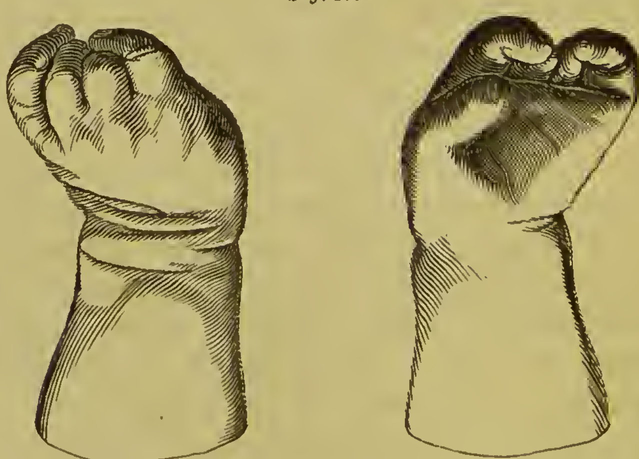
Fig. 136.

Fig. 137.

Hypertrophy of some phalanges, atrophy of others; marks of circular compression, as if by umbilical cord.

cumstance in connexion with this malformation is, that in a dozen or more examples the prominence of the bone, the depression in the integuments denoting adhesion, have

Fig. 138.



Generally imperfect development of carpus, metacarpus, and phalanges. Several terminal phalanges and nails deficient.

invariably occurred in the same situation, so that the

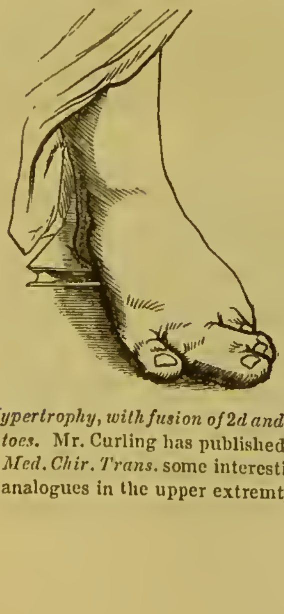
Fig. 139.

Deficiency of two fingers; the remaining ones tolerably perfect.

Fig. 140.

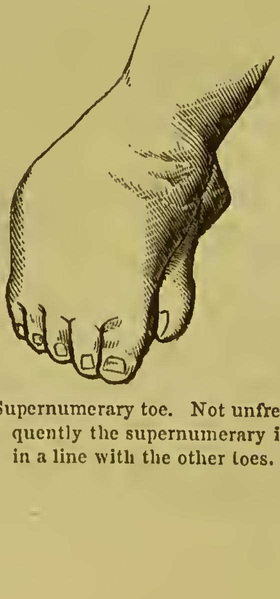
Valgoid malformation of left upper extremity; d, the shoulder, *e,* the olecranon, imperfectly developed. Absence of thumb, fusion of first and second fingers; *w,* inferior extremity of ulna. If, as already suggested, this be the advanced stage of fig. 132, absence of thumb is readily explained. In the nascent state of the limbs in which these malformations occur, the thumb would especially suffer from compression in the abnormal flexure.

Fig. 141.



Hypertrophy, with fusion of 2d and 3d toes. Mr. Curling has published in *Med. Chir. Trans.* some interesting analogues in the upper extremty.

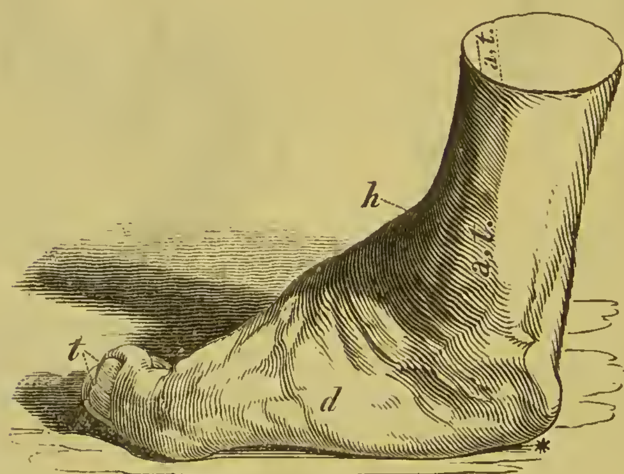
Fig. 142.



Supernumerary toe. Not unfrequently the supernumerary is in a line with the other toes.

cause of the curvature and fusion must in all cases have been identical. It is difficult to comprehend that an external cause, acting upon the fœtus, would invariably influence the member in a determinate manner. It is more consistent with the pathology of non-congenital distortions to regard the injury of the bone as the result of muscular action. It corresponds with the production of angular curvature of the tibia in rachitis. The firmness of the bone being impaired in this disease, the action of certain

Fig. 143.



Anterior view of uncommon malformation in which the valgoid form is perceptible. Fusion of parts with deficiency. Notwithstanding the extreme departure from the normal form, some of the principal parts of the normal foot could be indicated. Thus the letter *d* marks the situation of the dorsum of the foot; *t*, the great toe and adjacent toe fused together; *h*, the heel; *a t*, the situation of anterior tibial tendon, which could be voluntarily acted upon.

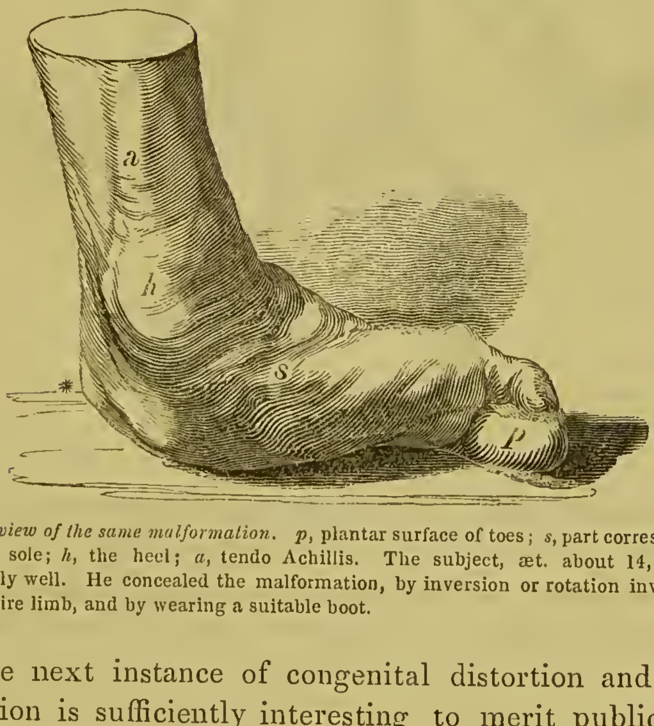
muscles becomes disproportionate, and suffices to bend this organ, as formerly described in the lecture on rickets.

The malformation in question is susceptible of great amendment; by section of gastrocnemii and peronei, with subsequent mechanical treatment, a very useful member is obtained. Sometimes both limbs are thus affected, and often the knees and hips are involved. This malformation of the tibia is sometimes combined with T. varus.

Congenital deformity of the spine is rare; its treatment

may be deferred to the lecture on Spinal Curvature. [The figs. 136 to 144 represent the malformations which oftenest present themselves in medical practice. When susceptible of relief, they require to be treated according to common principles. The author has usually overcome shortening of parts in these cases by mechanical extension, having been unwilling in the treatment of malformations, at the best capable only of slight amelioration, to employ tenotomy with the risk of discrediting it.

Fig. 144.



Posterior view of the same malformation. *p*, plantar surface of toes; *s*, part corresponding to the sole; *h*, the heel; *a*, tendo Achillis. The subject, æt. about 14, walked tolerably well. He concealed the malformation, by inversion or rotation inwards of the entire limb, and by wearing a suitable boot.

The next instance of congenital distortion and malformation is sufficiently interesting to merit publication in these Lectures. It was that of a male child, and is thus recorded in the author's journal: "The father is a person of literary and sedentary habits, the mother a person of delicate frame, subject to dyspepsia, hepatic derangement, hemorrhoids, attacks of constipation lasting from ten to twenty days—the bowels in fact rarely acting except at intervals of several days; she has borne one

other child, at present aged about three years, delicate, and liable to 'fits' during dentition. Whilst pregnant with

Fig. 145.

Congenital distortion and malformation. Left limb almost entirely severed in utero, probably from constriction by umbilical cord.

the subject of these remarks, she suffered greatly from the movements of the fœtus, and from pain in the right iliac fossa. During three months preceding parturition, which occurred at the eighth month of gestation, she was confined to her apartment, and became helplessly weak. The labour itself was not difficult; but at the birth the accoucheur observed that the limbs were encircled by the umbilical cord in an extraordinary manner.

"The child is two months old, well nourished and lively; the head is less firmly supported by the cervical muscles than usual at this age, and sinks towards the left

shoulder. On the left side of the neck a deep groove is perceptible, the transverse processes on right side of neck being particularly prominent. It appears probable that during uterine existence the head has been constantly in close apposition with the left shoulder. The trunk appears disproportionately large, even in relation to the usual predominance of this part in infancy* —probably the result of the intra-uterine arrested development of the lower extremities, and their deficient growth subsequently to birth. The four extremities are malformed, each of the upper extremities being similarly affected, whilst in the lower limbs the deformity appears to differ on each side. Examined in detail, the arms are observed to be inwardly rotated to the utmost extent, the shoulders prominent from deficient development of deltoids; superior articulations of the humeri movable, but the limbs can be carried upwards and outwardly to a less extent than in other directions. The olecranon processes present outwardly and somewhat anteriorly; very slight mobility at elbow-joints exists; in consequence of the inward rotation of humeri, the forearms are moved during flexion towards the dorsal rather than towards the anterior aspect of the body, as in the natural formation of these organs. The wrists are pronated and flexed; the palms presented outwardly, in consequence of the inward rotation of the humeri; whilst the inner margins of the hands are approximated to the ulnas. The thumbs and fingers are contracted towards the palmar surfaces, but little mobility of wrists and fingers remains. The humeral portions, especially towards the shoulders, appear less fleshy, and the right hand is more atrophic than the left. A slight groove, concave from above downwards, extends across the dorsal surface of left metacarpus; whilst a continuous groove, extending in a spiral manner about two turns and a half around the lower portion of forearm and carpus, gives to this hand and arm a singular

* The drawing is in this respect inaccurate.

shape. This groove, in a part of its course, namely, on the proper anterior surface of the extremity of the fore-arm, increases to a deep cleft, the integument at bottom of this cleft being abnormally adherent to the subjacent bones.

"The thighs are rotated outwardly; the patellæ consequently, of which the left is more rudimentary than the right, present externally; their situation is marked by a deeply wrinkled depression in the integuments, to which they appear to adhere. The knees are somewhat contracted, the obstacle to their extension being firm, the left more unyielding than the right. The feet have the form of Talipes varus, the right assuming the intermediate, and the left the most complete grade of that affection. A crease, deeper on the internal than on the external aspect, extends spirally around the middle of the right thigh; whilst four spiral turns of a deep cleft exist in the left limb, two above and two below the knee-joint. About the middle portions of the left thigh and leg respectively, two spiral turns (*b* and *c*) constitute fissures so deep that the cutis is here in close proximity to the bones; the intermediate portion of the member (*d*) being connected with upper portion of the thigh and the lower portion of the leg, by the attenuated thigh and leg bones, invested in these situations by very fine integument only. In fact, where the two principal clefts occur, the distal portions of the member are maintained in connexion with the proximal portions by merely the shafts of the bones, the nerves and blood-vessels, and thin laminæ of cutaneous tissues. The parts of the member placed between the two principal grooves are, on the contrary, bulky—preternaturally developed."

Such were the deformities in this unfortunate infant, whose functions of organic life were naturally performed. The author's opinion being requested respecting the practicability and propriety of adopting remedial means, he was induced to state his belief that, whilst the lower extremities

might be sufficiently restored for the purposes of imperfect locomotion, and the upper extremities improved to the extent of enabling the infant to approximate the hands to the mouth, yet that very slight general function of the hands and arms would be obtained. Section of Achilles tendon in both feet, that of tibialis posticus in left foot, application of splints, with manipulations to the ankles, knees, and wrists, and a spring instrument applied for gradual flexion of the elbows and inward rotation of humeri, sufficed, within six months, to effect first part of treatment, namely, the restoration of nearly complete form and flexibility. Three months later, the child had acquired some power; he was enabled to shrug the shoulders, inwardly rotate the arms, and grasp toys with the hands, but had obtained no capability of voluntarily acting upon the deltoids and raising the arms; the voluntary movement of the elbows was exceedingly limited.

The form and flexibility of the feet were fairly restored ; the processes of the left tibio-tarsal articulation remained sparely developed ; the knees were much straighter, and more movable; the outward rotation of the thighs much less constant; the child could playfully throw these limbs about, adduct them, partially bend the knees, and gave promise of realisation of the expectations entertained of their restoration to a certain degree of usefulness.

At eighteen months, however, having occasionally suffered whilst cutting teeth, he was carried off somewhat suddenly by convulsions.

Death having occurred at the distance of 200 miles from London, no opportunity of post-mortem investigation was offered.

The links in the chain of pathogenetical causes were probably as follow: Impaired constitutional power in the parent having predisposed to derangement in the cerebro-spinal system of the embryo—intra-uterine convulsions of the fœtus—atony and paralysis of certain muscles, with

inordinate action and shortening of other muscles, as consequences of such cerebro-spinal derangement—entanglement of limbs by funis (itself the accidental result of the convulsions, but the cause of the uncommon spiral grooves, fissures, and clefts).]*

I have entered slightly into the consideration of the causes of these malformations; enough has been said to suggest to you materials for thinking. Some of you may avail yourselves of the hints given, and be enabled, by further research, to clear away the difficulties that surround the comprehension of intra-uterine abnormal acts. It was remarked to me by Stromeyer in 1835, that in his opinion every congenital change of form (whether true malformation or distortion) would some day be traced to abnormal muscular action. This opinion may be too exclusive; but I believe I have been able to confirm, in many respects, the dictum of this able pathologist and practitioner.

* Dissertatio de Acephalis, Elbin: Berolini, 1821.

LECTURE XVII.

On deformities of the spinal column—Angular curvature from scrofulous disease of the column and from injury—[Lateral deformity from struma, rheumatism, injury—Disease of vertebræ mistaken for pulmonary consumption, for hip-joint disease—Mode of production of paraplegia—Terminations of strumous disease of vertebræ]—Angular curvature from rachitis—[Antero-posterior curvature—Incurvation]—Treatment—Complication of neuralgia and spastic contraction of muscles of the limbs—Congenital spinal deformity.

In this lecture I propose to describe the principal forms of spinal deformity, and to compare them with the distortions affecting other parts of the frame. The observations I have to make will be compressed into the smallest practicable space. Much has been written on the subject of spinal distortions, yet it is probable that the members of the profession are less agreed respecting their nature, or at all events less satisfied with the mode of treating these complaints, than with the knowledge possessed of any other branch of pathology. For my part, I may confess, that at a period when the pathology of other distortions had ceased to be a source of embarrassment, that of spinal curvatures appeared to be involved in so much obscurity that I became convinced of the necessity of commencing a fundamental inquiry into the subject. I shall endeavour simply to relate the principal pathological phenomena on which a proper comprehension of those distortions, in my opinion, depends.

The nature and treatment of spinal distortions has appeared obscure, because they have been long treated as a speciality, instead of being investigated in connexion with universal pathology (1843). I do not mean to assert that they have not been properly studied by numerous practitioners here and elsewhere, but that by the majority of

writers on spinal distortions they have been regarded in too narrow a point of view. Disease affecting the various structures composing the vertebral column has too often been supposed to follow a course peculiar to this region; whereas observation shews that a certain kind of disease being given, it may properly be inferred that its effects in this region will correspond with its effects elsewhere. If the vertebral column be examined, it is found to be composed of bones, ligaments, intervertebral bodies, muscles which regulate the position of the whole, and a nervous cord contained within the column. The last may, for the present, be excluded from our consideration, as any lesion of its texture is entirely secondary. Of the remaining structures the intervertebral bodies may be dismissed, as it is universally admitted that in the ordinary forms of spinal deformity they are also secondarily affected. We have, then, to consider the diseases of the bones, ligaments, and muscles of the vertebral column, and the resulting deformities. It may be asked, Is there any known difference in the composition of the bones, ligaments, and muscles of the spine, that any difference in the effect of disease in this region compared with its effects upon the bones, ligaments, and muscles of any articulation of the upper or lower extremities should be anticipated? We know of none. The effects of disease in this situation may be modified by the peculiar functions of the spinal column, its office being to support the head and trunk in its erect posture, and to serve as a *point d'appui* for the action of the muscles of the extremities. The spinal column is, from the nature of its office, exposed to disadvantages from which the members are more free. If, for instance, an individual have strumous disease of an articulation of the lower extremity, the use of the articulation may be entirely discontinued, either instinctively or as the result of proper advice. The effects of the disease are confined to the loss of the use of the articulation and a certain constitutional disturbance. But if the same disease should attack one or more of the articu-

lations of the spinal column, the office of this part is such, that during every movement of the frame, and during the principal movements of the members, the diseased part of the spine is exposed to vibration and motion, from which the articulation of a limb is exempt. In the extremity the weight of the body is not necessarily borne on the affected part; it may, at the commencement of the disease, be easily withdrawn from it by repose of the member. In order to give the spine repose, we are compelled to rest the entire frame. In the spine the difficulty of diagnosis often prevents recognition of disease in its earliest stages; it often proceeds unnoticed until indicated by deformity (p. 346).

After these few general observations, you are ready to infer, that as disease may affect the articulations of the extremities, similar results may occur in those of the vertebral column. Struma, accidents, and rachitis are common causes of deformity in the extremities, and it will excite no surprise to hear that these causes may equally affect the component parts of the vertebral column. The muscles of the spinal column are in structure identical with those of the extremities; and wherefore should they not participate in paralysis and spasm, and undergo atrophy, organic shortening, and elongation, abnormal conditions which, as we have seen, are so common in the different members? As, in a limb, improper positions may induce deformity, should we not expect that vicious attitudes should occasion spinal distortion? and, lastly, as congenital deformities occur in the limbs, ought we not to anticipate their occurrence in the vertebral column? In short, then, you are prepared to understand that the pathology of deformities of the spine perfectly corresponds with that of the members. The time at my disposal will preclude allusion to every variety and symptom of spinal deformity. I shall principally confine myself to analogies, and describe the characters and treatment of the most common distortions of this part.

Strumous Disease and Deformity of Spinal Column.

A common disease of the extremities of the long bones, the condyles of the femur for example, in which the cancellous structure so largely predominates, is the transformation of this structure into a material of less density and strength, apparently from removal of calcareous particles, and deposit of tuberculous matter in their place. The ligamentous structures equally suffer in many cases. You know further, that considerable deformity of the knee may result without occurrence of external suppuration; that is to say, without formation of what is technically denominated abscess; whilst, in other cases, the product of inflammation of the joint, and of the disorganisation of the bones and ligaments, is discharged externally. The same processes occur in the spinal column, the bodies of which equally abound in cancelli. When the individual walks with an articulation of the lower extremity thus affected, the part yields to the superincumbent weight; or, whether the use of the part be discontinued or not, the stronger mass of the muscles displaces the articular surfaces, flexes the articulation, and in time, these muscles becoming structurally shorter, permanently contract the articulation. In the same manner, when the structure of the bodies of the vertebræ and the ligaments become disorganised by strumous disease, the part either yields beneath the superincumbent weight of the head and upper portion of the trunk, or curvature forwards of the thorax ensues, through the action of the abdominal muscles. These, by the advantage of their mechanical arrangement, possess a greater power of bending the spine anteriorly than the large muscles of the spine have to draw it backwards beyond the perpendicular line.* The arrange-

* General writers on morbid anatomy, and special authors on distortions, abound in materials illustrative of the morbid anatomy of disease of the spine, and the mechanism of the production of curves and supplemental curves whenever the equilibrium of the column is disturbed.

ment of the transverse and spinous processes prevents a backward falling (incurvation) of the upper part of the trunk, especially as the body of the vertebra is the principal seat of the affection. The distortion seldom occurs in these cases laterally. It is sometimes both forwards and lateral.* The falling of the thorax taking place anteriorly, the spinous processes of the decayed or carious vertebræ project posteriorly, hence *angular curvature* results (*cyphosis, gibbus*). In this series of models of angular curvature from this cause, you may observe the great extent of deformity, and consequently how large a number of vertebræ has participated in disease. This model (fig. 146) will shew you the ordinary situation of the curvature; it involves, in this instance, the whole of the dorsal vertebræ. You are rendered familiar with scrofulous disease of the vertebræ in the mode in which it affects

Fig. 146.

Extreme Angular spinal curvature from disease and caries of vertebræ (ankylosis).†

* The author refers the reader who may be desirous of studying in detai the different forms of *disease* of spinal column to the writings of standard authors on general surgery, amongst whom Stromeyer stands pre-eminent for his treatment of this subject (*Handbuch der Chirurgie* von Dr. Louis Stromeyer, Freiburg im Breisgau, 1846; vol. i. part iii. *Principles and Practice of Surgery* of Ferguson, Pirrie, and Miller). Stromeyer has explained the occurrence of lateral yielding of the column, and the rotation which occurs in some instances from strumous synovitis. He thinks it arises from tumefaction of the *ligaments* of an articulation of the oblique processes and augmentatiou of synovia in this joint. "A lateral curve of more angular character, limited to a small number of vertebræ, occurs, which is usually compensated for by other gentle lateral serpentine curves of the column. By this means the equilibrium is restored, and the deformity remains unperceived through the dress" (p. 545). A case of extreme lateral displacement of vertebræ from strumous or rheumatic disease, which had been mistaken for cancerous or other tumour, was recently described to me by Mr. W. Adams.

† The illustrations of spinal deformity by Bampfield, Shaw, Harrison, Lafond, Delpech, Humbert, Pravas, and many others, who wrote before the

the lumbar vertebræ, by the frequent production of lumbar or psoas abscess. The cervical vertebræ also are often the seat of the affection, the resulting deformity being either angular or lateral. When the latter exists, the position of the head resembles that in wry-neck. You will be daily informed that the spinal disease has resulted from injury. As in strumous diseases in other situations, so in the spine, an injury to the part may have provoked the development of disease; but whether clearly preceded by injury or not, the progress of disease and deformity is uniform. Angular curvature may result from premature over-exertion in a stooping position, in a susceptible constitution.

Fig. 147.

Distortion of front of chest consequent upon angular spinal deformity.

[The chest undergoes considerable change of form in angular spinal deformity, the inferior ribs appearing much compressed laterally, and the sternum, as at fig. 147, very prominent, especially at its inferior extremity.]

In practice, cases of this spinal deformity will be presented to you in which *disease* still exists, whereas in others you will have solely to give an opinion concerning the remediableness of deformities in which false or true *ankylosis* may be present. So long as you recognise the existence of diseased action, the object you will have in view will be to diminish the local disturbance by counter-irritation, and sometimes by leeches; to improve the state of the constitution by proper diet and air, administration of steel, iodine (ol. morrhuæ), with occasional laxatives, and endeavour to prevent deformity by suitable position. Ankylosis and deformity are said to be

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publication of these Lectures, enable the author to dispense with illustrations of every stage of spinal angular deformity. The author has adopted a contrary course with the illustration of many distortions of the members, not only with the view of facilitating comprehension of the subject, but because some of those distortions were first brought to the notice of the profession and described by himself.

necessary for the recovery of persons thus affected. No doubt can be entertained that when the bodies of numerous vertebræ are destroyed by caries or interstitial absorption, the falling in of the vertebræ and consolidation of their remains is essential to recovery from the primary effects of disease. It is equally certain that the perpendicular position of the trunk, and consequent pressure of the vertebræ upon each other, is one of the circumstances which not only aggravates the disease in its several stages, but tends to increase the destruction of the bodies of the vertebræ. The recumbent posture is, in these cases, universally acknowledged to be essential. Some practitioners recommend the prone position, and in many instances this is preferable. You will decide on repose, either on the chest or back, according to the circumstances of the case. When, for example, the lumbar vertebræ are diseased, the prone position leaves the bodies of these vertebræ less exposed to pressure than when in an intended horizontal position on the back in a common bed; the head and shoulders being raised by pillows, a bent position is attained, which favours lumbar, dorsal, or cervical posterior protrusion.

When, on the subsidence of local diseased action and consequent constitutional disturbance, you are consulted concerning the angular deformity dependent upon destruction of bodies of one or more vertebræ, it is necessary to determine, 1st, whether any means for straightening a spine under such circumstances can be resorted to; or 2d, whether any means can be applied to prevent increase of deformity. The first is impossible; or, if possible, the straightening would not be permanent. The second is practicable. If you reflect on the tendency to increase of deformity evinced in every part of the frame when the superincumbent weight is improperly received and transmitted, you will suppose that on the occurrence of a spinal curvature from scrofulous disease or from injury, the proper

relation of the parts of the column being destroyed, the weight of the head and shoulders will operate disadvantageously, and tend to increase the deformity. Such is the fact. We daily observe, in young people, even after the cessation of vertebral *disease*, that unless the spine be supported, the angular curvature, confined at first to a few vertebræ, extends to the greater part of the column. It is therefore essential to continue recumbency long after the subsidence of strumous spinal disease; and if exercise be permissible before adult age is attained and the growth of the frame perfected, proper mechanical support to the spine is needed. Use the opportunities of watching the effects of this disease in private practice as well as in this institution, and the accuracy of the remarks made on the necessity of mechanical support in these cases will be confirmed. Many prejudices exist against mechanical support; these have arisen less from any injurious influence really exercised, even by inappropriate apparatus, than from the frequent inefficiency, even of the best-constructed piece of mechanism, to arrest the tendency to increase of deformity. For apparatus see Lateral Curvature, p. 356 and p. 375.

[The progress of strumous *disease* of vertebræ is often destructively insidious, and sometimes simulates other diseases. Thus the author has repeatedly been consulted for the resulting *deformity* of the dorsal region in adolescent cases, which in the early stage had, on account of the attendant failure of general health, with cough and hectic symptoms, been attributed to phthisis. It is not surprising that so serious a disease as tuberculous degeneration of upper and front part of the thoracic vertebræ, with tuberculous suppuration in that locality (not necessarily proceeding outwardly), should disturb the bronchial glands (these being sometimes conjointly affected), and the roots and apices of the lungs, and closely simulate phthisis. *Disease* of dorsal vertebræ often proceeds to considerable extent without detection, through inattention to "ocular investigation of

the chest." Sometimes the occurrence of dorsal deformity is fearfully rapid, not even discovered until a sudden attack of paraplegia has exposed the true nature of the illness under which the patient has laboured. The author has witnessed one case in which the bodies of several dorsal vertebræ had been excavated by chronic strumous disease, the undermining process having proceeded until the spinal column suddenly, in a single night (as was reported), gave way. Possibly, in some similar cases, the first visible traces of deformity having been simply overlooked, the sudden paraplegia has resulted from the tolerance of compression by the spinal cord having reached its maximum; precisely as a certain amount of physical cause of apoplexy or paralysis within the cranium may be tolerated without warning, whilst the smallest addition to the existing lesion suffices to excite the whole of the symptoms.* Many cases of angular deformity (perhaps the majority) take place without pain. Some patients complain of pain along the course of the intercostal nerves, or in the upper or lower extremities. Pain is rarely referred to the affected spot, sometimes only upon voluntary motion, or when the trunk is improperly moved by the attendants.† Strumous disease of the lumbar vertebræ sometimes simulates hip-joint disease. The disease being situated on the anterior portion of the column, involves neighbouring structures; whether or no any pus be formed and point outwardly, the psoæ muscles, usually on one side only, are, from juxtaposition and mechanically,

* Paralysis is not in proportion to deformity; it may either precede deformity or even independently occur, not always through mechanical compression, but from disease of vertebræ extending to the cord or its membranes. Paralysis of upper extremities may occur from struma affecting cervical vertebræ.

† The only safe mode of moving or carrying severe cases is upon a sheet or litter, in the horizontal posture, by which means the weight of the head, trunk, and limbs being equally distributed upon the supporting surface, the spine is protected from any strain. On the contrary, the act of lifting the child by the head and shoulders and pelvis, in the ordinary manner, tends to bend the spine at the weakest part.

interfered with, the voluntary movement of the hip suffers, claudication and atrophy ensue, and sometimes disease of hip is incorrectly diagnosed (see note, p. 66). These errors of diagnosis are sometimes excusable, as the constitutional symptoms of strumous disease in the lungs, vertebræ, or hip are the same. The total oversight of the disease is not remarkable when its course is very chronic, and the constitutional reaction is so feeble as not to engage attention.

The most favourable termination of strumous *disease* with deformity of cervical, dorsal, or lumbar portion of the spinal column, is that in which the disease proceeds in a chronic form—involves a limited number of vertebræ only, and the resulting accumulation of pus or softened tuberculous matter is not discharged outwardly or into neighbouring internal organs, but is absorbed, leaving only the putty-like or calcareous deposits found many years afterwards attached to the front of, or in the vicinity of, the decayed bodies of the vertebræ. Sometimes the pus travels outwardly, constituting the too well-known psoas and lumbar abscesses. In some instances, probably, the matter takes the course of the root of the lungs, the bronchial glands, and the trachea; although this is a comparatively rare termination. It may be discharged into the descending colon, and escape per anum.* Profuse suppuration may continue for weeks through this channel, with simultaneous evacuation of masses of coagulated lymph; the so-called "sloughy cellular membrane" discharged from abscesses in the limbs much resembling the material discharged in diarrhœa tubularis† (croupal). The author in

* See Pirrie, *Principles and Practice of Surgery*, p. 442: London, 1852.

† Hippocrates (Sydenham Soc. Transl. vol. ii. p. 603), speaking of disease of vertebræ, states, "some have been carried off by a dysentery when it becomes chronic." Dr. Adams, the learned translator, expresses difficulty in comprehending this assertion of Hippocrates, and states, "those cases in which the disease is said to be carried off by dysentery, were no doubt of a rheu-

one case thought he witnessed the discharge of a considerable length of gangrenous intestine.

It is unnecessary to do more than allude to some of the secondary evils of all spinal deformities, which diminish the capacity of the thorax and abdomen, and proportionately embarrass the functions of the contained organs (see p. 18). Chronic derangement of any or all of these parts is apt to be maintained; and the occurrence of any acute disorder within either of these cavities places the sufferer in disproportionate jeopardy, and frequently requires the most active treatment for its relief. This is especially the case when pneumonia, pleurisy, bronchitis, or broncho-pneumonia are produced. Thus venesection, a remedy so little employed in the present day, may in these subjects be urgently necessary as a mechanical mode of relieving the impeded organs. Or if the case be not sufficiently alarming to warrant any "heroic" remedies, the knowledge of the extent to which severe spinal distortion may aggravate internal disease will cause the attendant to be more than usually solicitous and vigilant during the earlier stages of inflammatory disease. These observations apply less forcibly to those affected with deformity who are persistent invalids than to those who are comparatively strong and able to devote themselves to the active duties of life, in whom, therefore, the stages of acute disease will proceed at a more rapid rate (p. 356).]

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matic nature, and not connected with organic disease of the vertebræ." The author's observation of the terminations of disease of the spine leads him to confirm the accuracy of the idea of Hippocrates, in so far as concerns the existence of a connexion between the dysentery and organic disease of the spine. By dysentery, Hippocrates here probably meant discharge of pus per anum, with, as he terms it, "blood and scrapings of the bowels;" or Hippocrates may have alluded to another fatal mode of termination of caries and deformity of spine, namely, that of diarrhœa, caused by tuberculous, follicular, and mesenteric disease, or by aphthous inflammation of the tube, with hectic.

Rachitic Curvature of Spine.

Angular [and posterior]* deformity often arises from that peculiar change in the bones, ligaments, and other fibrous structures denominated rachitis.† When the proper firmness of the parts of the vertebral column is so completely destroyed that its maintenance in the straight position is impossible, the thorax inclines forwardly, and an angular [or posterior] curvature, [excurvation] results. The curve, from this cause, is, as represented in this model (fig. 148), more uniform than from scrofulous disease [usually less angular, in fact]. Often one spot in particular cannot be accused as the seat of the curvature; the case resembles, in the commencement, the curve which may voluntarily, during health, be given to the column. When it exceeds this, a more decided angle is observed from the projection of one or more of the spinous processes. Ultimately the angular deformity may equal that from caries of the vertebræ, as at fig. 146. Corresponding concavities occupy the cervical and lumbar regions. Difficulty may occasionally be experienced in determining, from examination of the resulting deformity, whether the origin of an angular curvature has been scrofulous or rachitic. In the commencement no uncertainty can exist, the difference in the constitutional symptoms of struma and rickets being well marked.‡ The complication of

* The distinction between angular and posterior curvatures is unnecessary. Originally the term 'angular' was restricted to deformity from caries (struma); but deformity from this cause is not angular until it attains an advanced stage, and rachitic posterior curvature may become angular in its progress.

† Rachitic cyphosis or rachitic gibbosity, as distinguished from the similar deformities from strumous caries (ankylosis) (p 343).

‡ Portal and the earlier writers on spinal deformity have confounded caries of vertebræ, rachitis of the column, and ordinary "lateral curvature," under the one head of rachitis (ῥάχις, *the spine*). Rachitis, a general affection of the osseous system, was formerly supposed to be peculiarly connected with disease of the spine; whilst modern observation, guided by morbid anatomy, shews that scrofulous disease of the vertebræ ending in disintegration (caries)

other forms of strumous or rachitic disease with the spinal curvature will clear up all doubts, even at a late period, in the case. When local tumefaction and pain augmented on pressure exist, you will recognise the scrofulous disease. Rachitis produces its effects without local reaction [sometimes even without very evident general disturbance of health beyond weakness]. This rachitic deformity is identical in its effects upon the form of the column with the state often considered as mere debility. Infants may be brought to you presenting the first stage of angular spinal deformity, from having too early been excited to assume the erect posture, or from rachitism. Whether rachitic angular [or posterior] curvature occur in infancy or childhood, absolute recumbency is indispensable, until you perceive, by the indications of returning general health and strength, that the rachitic state of system has subsided. After the remarks in former Lectures on the general treatment of rachitis, it is unnecessary here to advert to it. Rachitic curvature may partake of the lateral as well as of the angular character.

The treatment of scrofulous and rachitic disease and deformity of the spinal column consists, for the most part, of alleviation of symptoms during their progress, improvement of constitutional powers, and prevention of deformity. We possess no royal means of restoring the proper firmness of the osseous and ligamentous fabrics. In rachitic

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is more destructive than well-marked rachitic affection. It will be seen in the next lecture that the author is of opinion that ordinary lateral curvature results from impaired nutrition of the muscular and osseous systems, and consequent debility of the vertebral column, and is therefore allied to rachitis. The circumstances which led the older writers to connect rickets with the spine, and *à fortiori* with the nervous system, were probably the frequent co-existence of rickets with hydrocephalic and hydrorachitic affections—the occurrence of nervous lesions in rachitis, incontinence of urine for example—the remarkable hollow of the loins (lordosis, λορδόω, *to bend forwards*), and retarded power of walking in rachitic children, incorrectly attributed to the weakness of paralysis. See Lectures on Paralytic and Rachitic Lameness.

deformity, you may with less hesitation recommend mechanical supports, as unquestionably greater benefit accrues from their use in these cases. After several years' duration even of rachitic deformity, the change of form induces other extensive changes of structure. Preparations in anatomical museums testify that, although changes of form occur without destruction of parts, yet in the progress of growth the development of some parts is impeded, and of others facilitated; so that in long-standing cases of spinal deformity from rickets, you may observe the vertebral bodies compressed, and altered in their individual forms to accommodate them to the altered relation of parts. This will explain the impossibility of [completely] rectifying the position of the column after several years' duration of deformity during adolescence (see note, p. 381).

Fig. 148.

Rachitic angular or posterior curvature of spine.

[A common deformity of spine arises from the age of six to sixteen, especially amongst rapidly growing schoolboys, consisting of slight posterior curvature (convexity backwards, excurvation) of upper dorsal region ("round-shoulders"), and incurvation, lordosis (concavity backwards), in the lumbar region. The remote cause is undoubtedly, in many cases, a slight constitutional taint of rachitis, proved by the child having whilst an infant suffered from genu valgum (p. 209) (perhaps very slight), or from rachitic valgus, or pigeon-breastedness (p. 214). The exciting cause is the undue proportion of time devoted to sedentary pursuits, especially to the excessive writing which characterises the system of education pursued at some public and private schools. In many instances, the hours spent in writing are uncompensated for by use of ample play-grounds, and encouragement to the rude amusements necessary for the

proper development of the boyish frame. Where no rachitic element is discoverable, debility from over-growth may have been the remote cause.

In the early stage this antero-posterior yielding of the vertebræ disappears when the subject is recumbent; but in the advanced stage the muscles situated in the concavities of the curves, as well as the articular surfaces, having adapted themselves to the altered relation of the parts, the change from the perpendicular to the recumbent posture effects no variation in the deformity of the dorsal region, and seldom in the lumbar region, unless the thighs be flexed; by which means the psoæ muscles being relaxed, the lumbar vertebræ sink towards the couch. Even this temporary alleviation of the deformity, with the lapse of time, disappears. This distortion may be accompanied with nocturnal inability to retain the urine; and by altering the angle of the upper outlet of the pelvis, may occasion in females, who at a later period become pregnant, difficulty in parturition. The injurious effect upon the thorax is less considerable than that resulting from other spinal deformities. The treatment of this antero-posterior vertebral curvature consists in obviating the constitutional rachitic state, when still present; in removal of the exciting causes enumerated; and by a judicious system of moderate gymnastic exercises and youthful strengthening games. If the lumbar hollow be very considerable in an adolescent, the distortion is never completely remedied.]

In discussing the practicability of straightening a spinal column that has long remained distorted from any of the causes which affect this region, it is necessary to take into consideration not only the nature of the primary lesion, but also the secondary phenomena resulting from the continuance of the column in an improper position. I have already mentioned a fact, which you may verify by examination of pathological specimens, namely, that the bodies

of the vertebræ, through curvature in any direction, are, during the period when the growth of the frame is in progress, retarded in their development on the side to which the spine inclines, whilst they may attain the normal proportion, or exceed it, on the convex side (see note p. 381). It follows from this circumstance that although after restoration in childhood and early adolescence, we may expect the parts of the column again to return to normal proportions, or to approach these, yet that after completion of growth, even if restoration of the perpendicular direction be possible, we cannot expect the pillar to maintain the position, unless, at all events, we should possess the means of supporting the spine for many years in a proper form by mechanical apparatus. Another secondary phenomenon results from the adaptation of the numerous ligaments of the column to the altered relation of parts. They become respectively contracted and elongated, and constitute a considerable obstacle to rectification. This obstacle will appear to you the more considerable when you reflect that the ligaments connecting each vertebra are naturally very short; and the shorter the dense unyielding substance to be stretched, the greater the difficulty of attaining this end. Again, the innumerable short muscles which occupy the spaces between the different processes of the vertebræ possess, for a similar reason, an equal power of obstructing restoration. When, in addition, you remember that the ribs may have become adapted to their altered relations, and have become changed in form and even adherent to each other, you will understand to what extent the new arrangement of these bones may impede recovery at a certain age.

These are considerations which, notwithstanding the conviction that the pathology of spinal deformities is that of the rest of the frame, and that similar principles should be applied to the cure of the same diseases wherever situated, guard the rational practitioner from disappoint-

ment. Deformities in the extremities, from incomplete *ankylosis,* or from rachitis, may be susceptible of restoration, owing to the facility and power with which mechanical means may be brought to bear in these situations; but in the spine mechanical appliances cannot be so advantageously and effectually applied. Hence the inutility, with reference to *cure,* of the numerous extension-beds, most ingeniously contrived for elongation of the spinal column. They may afford some relief in certain conditions; they may serve to remove pressure from nervous cords under certain circumstances; but this is the limit of their applicability. Much charlatanerie has been practised with couches of various kinds: every addition to a common couch, which subserves the comfort of the patient, which enables the individual better to minister to his amusement or occupation, is commendable; but every such couch, the claims of which as a "curative" method are advocated, is not entitled to your confidence.

I have already insisted upon the advantages derivable from support to spinal columns in strumous and rachitic curvatures particularly during the growing period of life. You should not conclude that this is the only period during which they may be required. Often at adult age, with recovery of robust health, no necessity for mechanical support may exist. You may constantly meet with persons thus deformed who perform most of the offices of life in comfort, unassisted by instruments; but if the individual be of a weakly constitution—a delicate female, for instance—the utmost relief is obtainable from proper support. Many individuals in this situation, to whom life appears a burden, will be so greatly benefited by removing the strain which is in these cases maintained upon the curved part of the spine, that they will acquire health and activity to which they may have long been strangers. It is unnecessary to describe all the forms of apparatus available in these cases. The principle upon which the

majority of these instruments is constructed is that of making the pelvis available as a fixed point from which metallic supports extend to the axillæ, or to the projecting ribs and angle of the spine. Splints formed of leather [or gutta percha] sometimes afford an efficient support to the trunk in the upright position (see p. 374).

Among the secondary evils of severe angular curvature [or posterior] from either of the causes enumerated, are neuralgic pains in the trunk and extremities, from pressure on the sensitive nerves as they emerge from the spinal canal; and a contracted state of all the articulations of the lower extremities, resulting from similar injury to the motor filaments. A smaller amount of pressure will suffice to produce neuralgia than spastic contraction of muscles; indeed the latter, when severe, appears to result from pressure (?) on the entire cord, and is usually accompanied with neuralgia. These serious complications may occasion excruciating suffering, and are difficult of alleviation unless the spine can, by the means already enumerated, be in part restored to a proper form. As a palliative to pain, narcotic applications externally, warm embrocations of laudanum, plasters of belladonna, and aconite, or the preparations of veratria may be employed. If the general health be perfect, the contracted state of the limbs have long been stationary and unattended with pain, you may infer that the contraction is less the result of actual pressure on the nerves than of organic shortening of muscles, from long continuance of the parts in a contracted position after subsidence of the contracting cause. Here the question of tenotomy may be entertained. I have occasionally had recourse to it with advantage; but I recommend previous perseverance in the use of frictions, manipulations, and mechanical extension.

The antero-posterior and the transverse diameter of the thorax are often enlarged, so as in some degree to compensate for the diminution of the perpendicular extent of

this cavity; more frequently, however, habitual dyspnœa, especially on exertion, exists. Hypertrophy and other derangements of the heart sometimes result from mechanical interference with its action; in more numerous instances morbus cordis arises, from the constantly augmented efforts necessary for increased propulsion of blood to compensate for the diminished capacity of the lungs. Heart-disease also follows a more rapid course. Subjects of severe spinal curvature of any description are in later life martyrs to indigestion, hepatic derangement, and hysteria [universal hyperæsthesia] (pp. 19 and 349). Constipation is likewise a source of great annoyance.

Congenital distortion of the spine is comparatively rare. Those extensive derangements observable in hemicephaloid and acephaloid fœtuses, and in spina bifida, as they possess no practical interest, and the subjects are seldom viable, may be excluded from consideration. I have met with cases requiring treatment in which the head was retracted posteriorly, through shortening of the trapezius and deeper cervical muscles. Tenotomy was not required in these, the subjects having been young infants; but, amongst other practitioners, M. Guerin has found section of trapezius necessary. Nearly the whole of the distortions of the spine in infants are non-congenital.

LECTURE XVIII.

Distortions of spinal column analogous to contractures in other parts of the frame—Spinal distortion from spasmodic and paralytic destruction of equilibrium of spinal muscles; [Spinal deformity from pleurisy;] from unequal length of the lower extremities—Ordinary lateral curvature—Remote and proximate causes; its nature and treatment—[Analysis of means of cure which have been recommended—Prevention of spinal curvature]—Inapplicability of tenotomy as a means of curing lateral curvature.

In the last Lecture, I described, as completely as the time permitted, angular deformity of the spinal column, consisting of partial or complete ankylosis, being the condition of the spine analogous to angular deformity and ankylosis of a limb from inflammation, the result of scrofula or accidental injury. I also demonstrated the nature of rachitic angular or posterior deformity, in which, you remember, the column bends through want of firmness in its component parts, the bones, ligaments, and muscles. The numerous models on the table illustrated the combination of angular curvature from these causes, with a certain amount of lateral deviation, angularity predominating.

I have in the next place to treat of those distortions of the spinal column, which in their nature correspond with *contractures* in other parts of the frame. *Contractures* are those distortions which result from the operation of causes which *indirectly* affect the articulations. You have witnessed contractures of every articulation of the extremities induced by destruction of equilibrium in the muscles, from spasm on the one hand, or paralysis on the other. We have studied the operation of burns, abscesses in the soft parts, gangrene, and ulceration, in the production of contractures; and we can apply the information

thus derived to the comprehension of the deformities of the spinal column. In the general remarks at the beginning of the last Lecture I laid down the proposition that, having in the spinal column bones, ligaments, and muscles, similar to those in other parts of the frame, we should expect to meet in the spine with pathological states.

Contracture of the hand and foot from spastic muscular action is very common; it may therefore be asked, Do we observe spinal *non-congenital* deformity resulting from spasmodic action of muscles? In my opinion, very rarely. Others have proceeded on the contrary assumption, and have resorted to tenotomy of the spinal muscles as freely as in the extremities. Stromeyer, the inventor of subcutaneous tenotomy of tendo-Achillis, who first recommended tenotomy in strabismus, was also the first to practise (anno 1835) section of spinal muscles. He operated in a case of active retraction of the rhomboidei muscles, with which a lateral inclination of the upper dorsal vertebræ was conjoined. But although the authority of Stromeyer confirms the existence of non-congenital distortion from abnormal activity of particular muscles, I believe that the occurrence is exceedingly rare. Stromeyer does not, however, like some other practitioners, regard ordinary lateral curvature as the result of active retraction, the cure of which they have attempted by tenotomy.

It may next be inquired, whether spinal distortion results from paralysis of particular muscles. My friend Stromeyer regards paralysis of the respiratory muscles as the primary cause of ordinary lateral curvature.* I am unable to agree with him on this subject. Observation has convinced me that the debilitated condition of the inspiratory muscles on the concave side of the chest in lateral curvature is a secondary lesion. In well-marked cases of partial paralysis of the voluntary muscles, affecting the upper and lower extremities of one side, and of those muscles of the trunk on one side which are interested in the

* The author believes that this is no longer Stromeyer's opinion.

movements of the shoulder and hip, and attached to the spine, even in children, I have been surprised to witness an absence of spinal distortion. In fact, excepting the distortions which may affect the cervical vertebræ from altered equilibrium of the muscles of the head and neck (wry-neck), distortion of the spine from spasm or paralysis of opposing muscles is exceedingly rare.

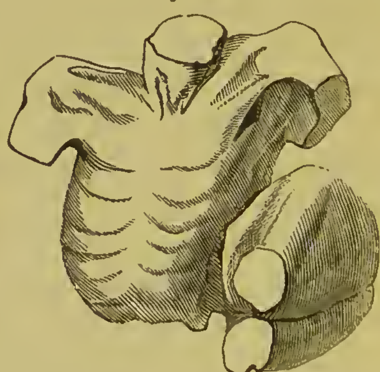
[Those of apparent distortion (see p. 112) may be omitted from further consideration. The subject is here mainly introduced for the purpose of illustrating the assertion that the spinal column is obnoxious to all the causes of deformity which affect the limbs.

When, however, the paralysis of one or both sides of the trunk is severe, the utmost deformity through collapse of the trunk may result, the act of sitting unsupported and that of locomotion being quite impossible.

The subject from whom the figs. 149 and 150 were

Fig. 149.

Fig. 150.



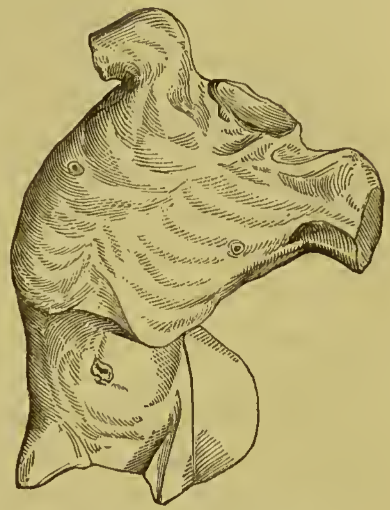
Extreme paralytic spinal deformity viewed from behind and from the front. The entire abdomen touched the couch. It is almost unnecessary to state that the paralysis and resulting deformity were incurable.

taken was affected with severe general paralysis of the trunk and limbs during infancy. The power of the upper extremities was recovered, whilst the trunk and lower extremities remained flaccid and atrophic. Similar slighter cases are narrated, p. 15.

Fig. 151 illustrates the same paralytic deformity when

the individual was supported beneath the arm-pits and against the sides of the lower ribs. It is in fact the position which the patient could for a short period daily assume in a chair properly padded and arranged for the purpose.]

Fig. 151.



Model of the subject of figs. 149, 150, *when supported beneath the arm-pits.*

Spinal distortion from burns, wounds, attended with loss of substance and subsequent cicatrices, are rare, because the spine is less exposed than the members to accidental injury. You can comprehend the manner in which cicatrices may distort the spine as well as other regions of the body.

[The spinal and chest deformity which, as well in children as in young adults, succeeds recovery from pleurisy, with effusion into the chest, requires mention here. Deformity thus produced appears to the casual observer similar to ordinary " lateral curvature of the spine ;" and when slight, even the experienced eye may sometimes hesitate in diagnosis. The dorsal curve in contraction from pleurisy is more uniform, involves the whole dorsal region, the depression of shoulder on the contracted side is relatively greater, the reduction of capacity of the contracted side applies to the front as well as the back of the chest, the posterior angles of the ribs on the expanded side are less salient, and rotation of the vertebræ on their horizontal axes is either entirely absent or very slight.

For many years the author was accustomed to regard the deformity of the chest and spine after empyema as a necessary and irremediable evil. Observation of the extent to which burn-cicatrices may in favourable situations be elongated, and the effect of exercise of the part in prevent-

ing recontraction and return of deformity, induced him, three years since, to attempt removal of the incurvation of chest and spine, which had occurred after empyema and paracentesis thoracis in a child six years old, an in-patient in the London Hospital. Before considering *prevention* and cure of deformity of this nature, it is necessary to reflect upon the causes which give rise to it.

Within the chest are the lungs long compressed by pleuritic effusion, sometimes perhaps condensed by exudation into their texture, and more or less tough cellular adhesions between the lungs and ribs, prone in the course of time to become fibrous and to contract.

The protracted immobility of the affected side of the chest places the intercostal muscles and the remaining powerful muscles attached to the ribs, and distributed over the chest, upon that side, in a condition favourable to structural shortening (p. 13). As soon as any reduction of the capacity of the affected side has taken place through absorption or evacuation of the contained fluid, the tonic contraction of these muscles comes more powerfully into operation, their fibres shorten, the side of the chest may even be compressed by them, or, at all events, they closely follow the reduction of its dimensions. Structural shortening of the muscles ensues after the same manner that it is produced during repose of an articulation in a bent position from disease. In fact, an analogy between the mode of production of a contracted chest from empyema and of a joint from inflammation exists.*

Reflection suggested that these deforming influences might be counteracted, and that possibly none of them could be considered insuperable obstacles to restoration. The patient was caused to lie upon the sound side, with

* Pathologically, a chest and spine contraction after pleurisy is more related to spinal distortion from disease (ankylosis); but morphologically it is allied to lateral curvature, and for convenience is mentioned in this Lecture.

a broad band passed beneath this part, attached above to the framework of the bed in such a manner as to cause the trunk to be almost suspended in this lateral position. The attachments of the band above the body were gradually shortened, until the weight of the head and shoulders above, and of the pelvis and lower extremities below, powerfully drew asunder the contracted ribs and vertebræ. In short, the plan adopted was that recommended for ordinary lateral curvature by Lafond, Shaw, and Lonsdale.

The child was placed in this position at first half an hour daily, the treatment gradually lengthened to several hours daily, and in a short time was cheerfully borne during the whole time the child was not engaged in running about for amusement. The beneficial effect of the treatment was visible after a few days' application of it; and at the end of three months the reduction of deformity was so considerable, as to leave no doubt of the possibility of obviating, at least in children, this serious termination of empyema.*]

Inequality in the length of the lower extremities has been assigned as a frequent cause of distortion of the spinal column. I have several times witnessed lateral inclination combined with actual difference in the length of the lower limbs, as when the growth of one had been impaired in childhood from scrofulous abscess in the leg and foot; but I have examined no case in which, notwithstanding the shortening, other causes of lateral curvature did not exist. On the contrary, it is very remarkable, according to my experience, that difference in the length of the lower extremities is so rarely accompanied with deformity of the spine.† Amongst many hundreds of cases of conge-

* The models of the case before and after treatment are in the author's possession, and are at the service of his medical brethren.

† The contrary has been often asserted. The conclusions on this head, published ten years since, were based upon observation; and it is useless to reason theoretically, that according to mechanical principles de-

nital and non-congenital spastic and paralytic deformity of one foot, submitted to my examination, in which a difference of half an inch to several inches in the length of the lower extremities existed, I have, with two or three exceptions, not witnessed the concurrence of spinal curvature. Some circumstances have operated in the exceptional cases to produce the spinal curvature. You should be cautious not to confound apparent with positive distortion. On examining the back of a person having, for example, one lower limb deficient one inch in length, you will frequently remark that a serpentine curve in the vertebral column exists; but on placing a book or other substance of the requisite thickness beneath the shorter limb, the curvature of the spine will disappear* (see fig. 33, p. 112). It is a fact of considerable importance in determining the causes of these distortions, that shortness of a lower extremity may exist during the twenty years preceding adult age

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formity *must* ensue when one leg is shorter than another. This bending of a point in pathology, easily proved by statistics, to suit a well-expounded theory of mechanics, reminds one of the exclamation of Chirac, a French writer on small-pox, "C'est en vain tu resistes petite vérole; je t'accoutumerai à la saignée." The truth is, that with a vigorous healthy nutrition of the spinal column, the tendency to deformity producible by a difference in length of lower extremities is obviated by vigorous use of the back; but when general debility, and weakness of the spinal column in particular, exists from state of comparative inaction of the part, as in the modern mode of rearing girls, an inequality in length of a lower extremity may act powerfully as an exciting cause of spinal deformity. Well-marked rachitic subjects, who have a considerable genu valgum, or other kind of shortening of one leg, are very prone to lateral curvature of the spine.

It will be hereafter seen that the *primary* or predisposing cause of lateral curvature is debility of the component parts of the column; whilst inequality of length of limb, certain occupations, use of particular parts, when present, are but *secondary* or exciting causes.

* The author's statement of the infrequency of spinal deformity and shortening of a lower extremity will be better understood by observing, that he does not consider a curve in the back to be a deformity which is removable on equalising the length of the legs, or on placing the individual in a straight position. Such a case is but a temporary malposition, often only voluntary (see p. 112).

without producing spinal deformity. Having rejected spastic muscular action, paralysis, and inequality in length of the lower extremities, as primary and ordinary causes of deformity of the spinal column, you are prepared to consider what is really the rationale of the production of the distortion of the spinal column denominated *lateral curvature* (*scoliosis*).* I shall not minutely examine the modifications of this curvature which occur; as, when you understand the ordinary form, you will, from your knowledge of the anatomy of this region and of animal mechanics, comprehend the origin of supplementary curves. For the same reason, the treatment of a case in which several causes exist requires to be conducted with reference to the primary distortion; if this be removed, the secondary changes in form spontaneously disappear. You perceive, in this series of models of ordinary lateral curvature, that the part of the column principally affected is the dorsal region, and that, in the great majority, the vertebræ of this part incline from the perpendicular position towards the right side. For a nearer appreciation of the phenomena presented in this deformity we will select this severe case of a young girl, thirteen years of age (see fig. 152). The peculiar character will be more evident than if I take an example of slighter deformity. You perceive that nearly the whole of the dorsal vertebræ have, in various degrees, yielded from the straight line, the fifth, sixth, and seventh vertebræ being situated three inches

Fig. 152.

Severe ordinary lateral spinal curvature viewed behind.

* Scoliosis habitualis, σκολιόω, to make crooked.

to the right of their proper position. The upper lumbar and the lowest cervical vertebræ project towards the left. The pelvis is situated obliquely, the left ilium greatly elevated, whilst the corresponding shoulder is depressed, the space between the axilla and ilium on this side not exceeding five inches; the ribs on this side are necessarily in close contact with each other, respiratory movements of the part being proportionately impeded. On the right side posteriorly the ribs are altered in form, and, with the scapula, form a large projection, the surface of which is three or four inches above the plane of the remainder of the dorsal region.

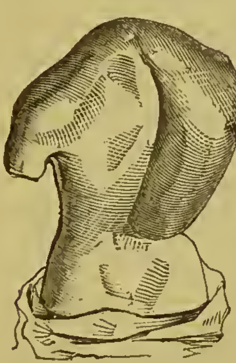
Anteriorly the deformity produced by severe lateral spinal curvature is even more considerable (fig. 153). In the left anterior mammary region the ribs are prominent. The head inclines forwardly through yielding of the upper part of the column, the highest point of which corresponds to the seventh cervical vertebra. The result of the large dorsal lateral curve, and of the secondary curves, is a great reduction in the entire length of the column; the lower ribs are in contact with the ilia, through which considerable diminution of the capacity of the abdominal cavity results. In studying, then, the anatomical relation of parts, you have to consider the diminution of capacity of the thoracic and abdominal cavities consequent on the sinking of the vertebral column, the impeded development of the left side of the thorax more especially, and the obliquity of the pelvis. If you attentively study this series

Fig. 153.

Severe ordinary lateral spinal curvature viewed in front.

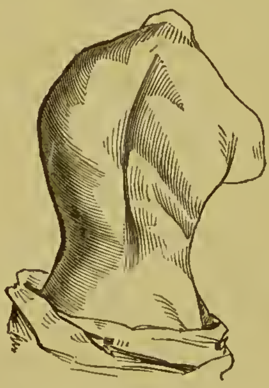
of models, you will notice that posteriorly the right side of the thorax, and anteriorly the left side, project beyond the plane of the contiguous part of the chest: this is only explicable by observing that a movement of rotation of the vertebræ on their horizontal axes has taken place, the articulating and transverse processes of the vertebræ on the right side being thrown backwards, whilst those on the left side are thrust anteriorly. This abnormal rotation constitutes the principal obstacle to the cure of severe lateral curvature. Having thus described to you the severe form of the affection, you can hereafter in practice have no difficulty in recognising it in the earlier stages; the principal points being unequal elevation of the shoulders, especially of the scapulæ, incipient prominence of ribs on one side, and of the ilium on the opposite side.

Fig. 154.



The usual direction of lateral curvature, namely, to the right side.

Fig. 155.



The uncommon example of lateral curvature to the left side.

["Lateral curvature of the spine" chiefly occurs on the right side,* or, in other words, the convexity of the dorsal curve is to the right, as in fig. 154; although, as shewn in

* Bühring† confirms the observations of Desruelles, Petrequin, and Hyrtl, that in the healthy and robust, besides the *normal* antero-posterior curves, a distinct thoracic curve of the spine to the right exists. This is attributed to the spinal column being unequally loaded at the sides in different parts,—on

† Die seitliche Rückgrats-Verkrümmung, von Dr. J. J. Bühring: Berlin, 1851.

the model, fig. 155, it sometimes occurs towards the left side.]

I will now endeavour briefly to explain my opinion of the mode of origin of this lateral curvature. In the last Lecture I demonstrated to you that when the bodies of one or more vertebræ are destroyed by scrofulous or other forms of vertebral disease, the strong muscles of the spine cannot advantageously resist the falling forwards of the

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the left, in the dorsal region, by the heart and great blood-vessels, and on the right by the liver. The ordinary dorsal curve in lateral curvature he proposes to term "cardiac curve," and the ordinary lumbar curve "hepatic curve." Besides the mere effect of relative over-loading of the sides of the column, Bühring, remembering the influence exercised during the developmental period by the arteries upon their contiguous parietes, even when bony, is of opinion that the heart and aorta obtain an increase of space by impelling the dorsal vertebræ to the right; whilst the liver and its vessels similarly dispose to the lumbar curve. A full account of the ingenious and scientific views of Bühring explanatory of the origin of lateral curvature from its prototype, a physiological state, would require more space than can be here devoted to the purpose. The author is by no means convinced that a "cardiac" or a "hepatic" curve does naturally exist; and, on the other hand, he is not prepared to deny that a curve requiring a more precise measure of a straight or curved line than the eye can appreciate may exist. The examination of a number of adults and children unaffected with distortion, taken indiscriminately, has satisfied him that no obvious *natural* lateral curves, such as Bühring describes, are present in healthy persons.

In the course of this investigation he has observed that the spines of healthy male children, about the age of ten or twelve, appear straight, perfectly free from lateral deviation. It is difficult in younger children to determine the point, as such individuals are not readily induced to remain still under examination, or to refrain from such movements of the trunk as interrupt careful observation. The author found that the dorsal region of young men, from the age of eighteen to twenty-two (the subjects were of the working class, in-door hospital convalescents), often presented irregular deviations of one or more spinous processes of the upper dorsal region. One spinous process, for example, often that of the second dorsal vertebra, deviated more than half an inch to the left, whilst the spinous processes of the third and fourth vertebræ inclined beyond the median line to the right. The cause of these displacements of single vertebræ in this region, which bear no resemblance to "ordinary lateral curvature," remains a subject for future inquiry.

column, hence a posterior projection of the region, denominated angular curvature. In like manner, when all the component parts of the spine, bones, ligaments, and muscles, are deprived of their proper firmness and tone in rickets, the spinal column, incapable of maintaining itself erect and of withstanding the influence of the weight of the thorax and the contained organs, which naturally tends to bend it forwards, yields, so that an angular or posterior curvature results. But in less severe rickets, or when constitutional debility exists, or when a child or young female is simply said to be delicate, the organisation of the more lowly organised structures, the bones and ligaments, suffers in a greater degree than the muscular system. The muscles of the spine participate in the debility; but they remain susceptible to application of the stimulus of volition, they are throughout the day instinctively occupied in the maintenance of the erect posture. This ability, sufficiently to react against the natural tendency of the thorax to incline anteriorly, prevents posterior curvature; but the same muscles do not possess sufficient power to prevent the operation of lateral displacing influences. That during the production, or in existence of lateral curvature, the efficient action of the spinal muscles is capable of explaining the absence of posterior curvature of the dorsal vertebræ, is shewn by the remarkable concavity which sometimes exists in the middle dorsal region. I have witnessed severe lateral curvatures in young females who were particular in their endeavours to maintain the perpendicular position of the spine by drawing inwards the dorsal and lumbar vertebræ and throwing the shoulders backwards. But as the firmness of the osseous and white fibrous structures of the spinal column is impaired in debilitated or delicate individuals, and the tendency to posterior yielding is resisted by the yet comparatively powerful spinal muscles, if any cause capable of disturbing the equilibrium of the powers which laterally maintain the perpendicular line of the spinal

column be applied, the result will be a lateral deviation. The rarity of lateral deviation of the spine, even in delicate boys, is well known; it appears to me to be equally uncommon amongst the children of the poorest classes of society, who are notwithstanding frequently affected with posterior curvature. But in females of the richer classes whose time is much occupied in sedentary amusement and instruction, and in those of the poorer classes who obtain their livelihood by sedentary employment, in over-worked, over-grown, and badly-fed boys, who labour at manufactures in which particular parts of the body are more excited to activity than others, spinal lateral curvature may be produced. It is apparent that the curvature is preceded and often accompanied by an imperfect nutrition or imperfect assimilation of food, diminished vigour and power of the nervous system, either from hereditary influence or from disproportionate abstraction of nervous energy from the animal and vegetative functions of the system and expenditure thereof upon the intellectual. Very many young women, of large stature and otherwise well developed, become the victims of lateral curvature from "outgrowing their strength," as it is termed; or, more strictly speaking, from the necessities of the system being insufficiently supplied by proper digestion and assimilation of food, outdoor exercise, and amusement. These are the remote causes of every case of lateral curvature; the exciting cause correctly assigned by the majority of writers on the subject being the undue exercise and development of the muscles attached to the ribs and spinal column of one side, subservient to the movements of one upper extremity, usually the right.* I have already remarked that the spine is liable to be influenced, particularly in youth, by every movement of the extremities; when the remote cause of

* Doubtful etiology may be determined by presence of analogous affections. Spurious valgus, or flat-foot (p. 231), often co-exists with lateral curvature, and, like it, is more common in the female than in the male sex.

spinal curvature, — debility, however produced, — exists, the spine is disposed to yield; and the direction in which it will yield will be determined by the nature and mode of operation of the exciting cause. When the right upper extremity is disproportionately exercised, an undue traction upon the dorsal portion of the spinal column takes place, succeeded by an inclination to the right side. When, therefore, the equilibrium between the muscular powers which laterally support the column is once destroyed, the increase of lateral inclination is rapidly effected, through the co-operation of numerous other injurious influences. Of these, particular positions of the body, as in writing, drawing, sewing, may favour the deformity. The habit of resting the weight of the frame, whilst standing, almost entirely on the right lower extremity, is calculated greatly to facilitate increase of the curvature.* The normal lateral movements of the spine become impeded on occurrence of morbid inclination to one side; hence those muscles affixed to the ribs and spine which effect these lateral movements are thrown out of exercise. Those situated in the concavity of the curve or curves being relaxed, gradually contract, and become ultimately structurally shorter; those on the convexity of the curve being in the first instance stretched or elongated, become ultimately debilitated and powerless. The total length of the column being diminished, the muscles which are principally concerned in preventing flexion of the column become in time structurally shorter, through the approximation of their points of origin and insertion. This structural shortening of muscles tends rapidly to in-

* The exciting eause of excessive use of one arm or leg is insufficient to produce distortion, without the constitutional relaxation of bones, ligaments, and museles; if it were, lateral curvature should always oceur in paralysis of one side of face, arm, trunk, and leg. The author has seen a ehild grow up to manhood with complete hemiplegia, without traee of lateral curvature. Werner relates a similar ease. The author, when the above Lectures were written, attached more importanee to exeessive use of right arm than it merits. He has also seen many dorsal eurves to the left in persons who were not left-handed.

crease the curve during the period of the growth of the frame. For as the muscles cease to be exercised, they do not keep pace in growth with the development of the skeleton; the individual bones of the column continue to enlarge, but as the muscles are structurally shorter, the addition to the aggregate length of the spinal column, consequent on the enlargement of the individual bones, cannot take place in a straight line, and the curve is consequently increased.

The constitutional debility attendant upon lateral curvature may continue during the entire period of the augmentation of deformity; often towards puberty an improvement is manifest; but in many cases, after a few years, the health again gives way, and the increase of deformity becomes a source of renewed anxiety. The appearance of the catamenia is usually deferred, and confirmed chlorosis occasionally coexists. In slight lateral curvature the health may appear unaffected to a superficial observer, or to some parents, who are more willing to attribute the deformity to an accidental cause than to constitutional disturbance. As I have already observed, the general disturbance, when slight, may be comprehended in the expression of the individual having outgrown her strength. In many cases the remote cause—debility—is too apparent to be overlooked, as when the deformity appears during convalescence from measles, hooping-cough, or other disorder of childhood.

When speaking of posterior curvature from rachitis, I alluded to its occasional combination with lateral deviation; I should also remark that lateral curvature, when severe, is usually complicated with posterior yielding of the column. The remote causes of the lateral and posterior curvature (from debility or rachitis) differ only in the degree of constitutional affection. If the latter be comparatively slight, the spinal muscles, which in health maintain the erect position of the trunk, prevent posterior curvature, but are incapable of preventing the column being unequally acted upon and drawn laterally by preponderance in the use of certain

muscles. When the constitutional debility is so great that the spinal muscles are incapable of preventing the anterior flexion of the column, posterior curvature results.

I have sufficiently swelled the catalogue of primary and secondary evils resulting from these deformities, independently of the mere disadvantage arising from being deformed, to urge you to study well the means of affording relief. When consulted in these eases, you will proceed to treatment, not only with the view of effecting a beneficial ehange in form, but with the gratifieation of endeavouring to relieve a physieal infirmity, and at the same time avert a series of lesions dangerous to life.

[The intractable nature of a disease being usually in proportion to the number of remedies proposed for it, a glance at the numerous means devised by the ardour, ingenuity, and industry of successive generations of orthopædic practitioners for "the cure of lateral curvature of the spine" will shew the difficulty of removing this distortion when fully established. They are all referrible to the following heads:

1. Improvement of the general health.
2. Meehanical supports or scaffoldings.
3. ,, compression of lapsed parts.
4. ,, elongation of the whole trunk.
5. Surgical division of contracted muscles.
6. Recumbency.
7. Gymnastics.
8. Automatic exercise of particular muscles.
9. ,, reetification of equilibrium of the column.
10. Topical application of medicines.
11. Electricity.

1. *Improvement of the general health* is necessary in all cases in the early stage, in many cases during the entire progress of the deformity, and, in some who may have previously become comparatively robust, at any period of the deformity, through the operation of causes connected with or foreign to it. In the child mere debility may ap-

pear to exist, or a feeble digestive or nervous system may require attention. Sometimes, at a later period, amenorrhœa or chlorosis is present. It has been asserted that the health and constitution of the subjects of lateral curvature are perfect.* This is only true of the later stages,† when, analogously to that which is sometimes observed after recovery from general rachitism, the person not unfrequently enjoys excellent health. It is unnecessary to detail the means of effecting the indication here presented. The principles of treatment consist in employment of a nutritious diet, tonics, gentle laxatives, suitable air and exercise.

2. *Mechanical supports or scaffoldings.* These means have been as much condemned by some medical men as their advantages have been extolled by others. An unprejudiced experience of many years of cases treated with or without their use justifies the assertion that they neither merit the praises lavished by some nor the anathemas of others. Too much has been expected of them. They are not adapted to the removal of the primary causes of lateral curvature; they cannot therefore be employed as *curative* means. As a scaffolding or a buttress may support an inclined building, in like manner a well-adjusted mechanical support may prevent further yielding in the

* Werner.

† Four stages of lateral curvature may be conveniently discriminated:

1st stage, that in which the spinous processes of the dorsal vertebræ deviate from 1 to 2 lines from their position.

2d stage, in which the whole trunk deviates to the right to the extent that a plummet suspended from the seventh cervical vertebra will deviate an inch from the medium line of the sacrum, the scapulæ and left hip being already considerably displaced.

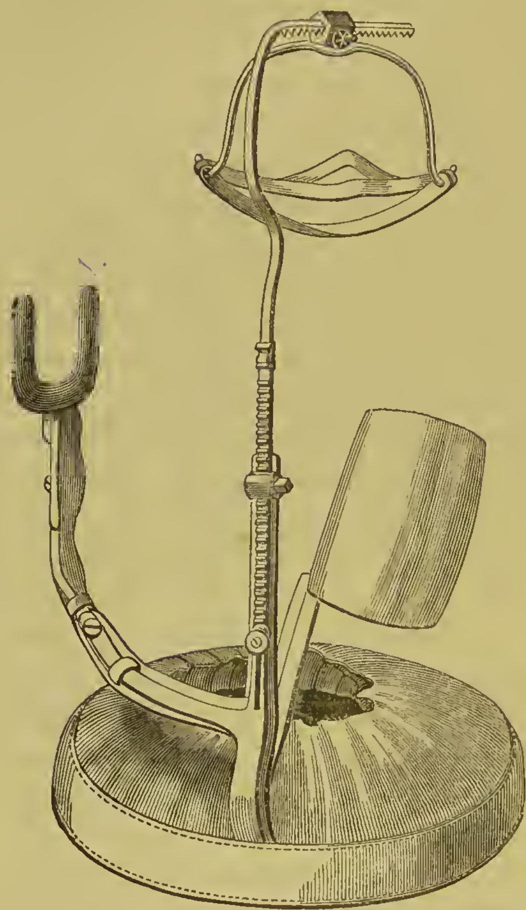
3d stage, rotation of vertebræ upon their long axes, absorption of their bodies on the concave side of the curves, shortening and organic changes in the ligaments, fibrous or adipose degeneration of muscles, may now have taken place. The deviation of the trunk to the right is not necessarily greater in this than in second stage; but the deformity of ribs anteriorly and posteriorly is greater. Extension in the long axis of the trunk scarcely effects even temporary improvement of form.

4th grade is no longer a lateral curvature, but a gibbosity; the right dorsal protuberance extends three or four inches beyond the left side of chest, the left axilla is close to ilium, and left intercostal spaces are extinguished.

improper direction—may prevent increase of deformity—may arrest the evil at the stage at which the machinery is employed. But even this admission of their utility is qualified by the results of experience, which shew that many lateral curvatures continue to increase in spite of instruments apparently well-adapted to the intention with which they have been employed. The causes of their failure frequently consist in some inherent imperfection, in the want of constancy in their use, their liability to shift in their adjustment through the continuous growth of the patient, and alterations in the character of the curvature. Numerous special writers on lateral curvature have described their respective instruments, the principle of all mere supports or scaffoldings to the trunk consisting in making the projecting hip-bone on either side, and the sacrum behind, the resting-points for the machinery to be erected for the support of the trunk. The pieces of machinery used for this purpose are usually a band of metal, leather, or similar material, to encircle and rest upon the pelvis; "crutches," that is, metallic or wooden pieces extending from the pelvis to the arm-pits; a back-piece, with or without branches, properly fastened to receive the pressure of the spine or of the lower ribs on one or both sides. Such is the apparatus more or less allied in its structure to the ordinary ladies' corset, and, like it, incapable of *cure* and often of prevention. Some of the older practitioners added to this contrivance a piece upon which, by means of chin and occipital straps, or by the intervention of metallic clasps, the head rests. An attempt is thus made to extend support to the head as well as to the trunk. The spinal support, with the head-prolongation, was termed the Minerva, and probably fell into disuse from its having been employed with *curative*, that is, a mistaken object, instead of being used as a potent auxiliary means of preventing transmission of pressure or weight to the ground or seat through the weak vertebral column,

and because its use is unsightly. With the limited but important objects undoubtedly attainable from a support, the Minerva (fig. 156) is a valuable means to be used in lateral curvature. It is particularly serviceable in the second stage of the deformity, when the mischief is inclined rapidly to progress; and as the subjects are usually during this stage young, the objection of its unsightliness is inapplicable. Even the principal part of the unsightliness is removable by the metallic parts being properly covered, and by the habiliments being suitably adapted to it. If the admission be made that the aggregate of the structure called the spine is weak in lateral curvature, or that when an abnormal curve in it has in any manner been produced, the greater the weight borne by the lapsed column, the greater will be the tendency to increase of the curve, it follows that it is desirable, when assumption of the erect posture is permitted in the rapidly-increasing stage of this

Fig. 156.



A light, efficient spinal support for lateral curvature during the remediable stage, with head-piece or "the Minerva" attached. The head-piece is removable. Two straps of india-rubber material are attached to this piece, one to receive the chin, the other to pass under the occiput.

deformity, to remove if possible the weight acting as a cause of the augmentation of deformity. Moreover, lateral curvature is particularly prone to occur in weakly subjects, who enjoy a larger cerebral development, and who present a more slender figure than others. Sturdy children rarely become the subjects of this distortion.

3. *Mechanical compression of lapsed parts.* At all times recourse appears instinctively to have been had to mechanical pressure against the convexities of the several curves offered by the distorted column. This compression or pressure has been exercised in various modes, as by the hands of a strong attendant, by pads, screws, or springs attached either to mechanical supports or to couches, recumbent frames, and beds; sometimes by suspensory straps, as described p. 362. But although common sense suggests employment of this means, experience demonstrates that its usefulness is only in proportion to the youthfulness of the patient, or the earliness of the period at which it is employed; and that after the deformity is confirmed and the tissues have become inelastic through age, it constitutes a means unequal to the end. It may, however, be used as an auxiliary to other means; and if *constantly* used, a slight amount of pressure does exercise a greater influence in replacement than might be expected from the small amount of power employed. An objection to its use is, that when applied to the part where it is most indicated, viz. to the ordinary dorso-costal protuberance, the whole of the force employed is not, as intended, directed against the sides of the lapsed vertebræ, through the intermedium of the ribs attached to the oblique and transverse processes; but owing to the elasticity of the ribs in young subjects, the power is mainly expended at the angles of the ribs, the ordinary prominence of which in lateral curvature is often thereby increased. Compression, by means of an instrument of iron or wood, against the convex side of the spinous processes of dorsal vertebræ has been much but ineffectually employed

for the removal of the peculiar rotation of the vertebræ on their horizontal axes, which constitutes so insuperable an obstacle to restoration in the advanced stages. Compression of the spine and ribs by means of the "shield" of the late Dr. Harrison, used in the recumbent posture, which consists of a broad thick wooden splint, may be carried to so great an extent as to obliterate the *natural* antero-posterior curves of the dorsal and lumbar regions. The author, in consultation with Mr. Norwood of Hastings, saw a patient, of the susceptible age of eleven, who had been thus deformed for life by intended curative efforts.

4. *Mechanical elongation of the trunk* has been employed in a variety of ways. The simplest mode has been the act of swinging by the hands from a cross-bar, suspended at each end from the ceiling. This swinging has been expected to act beneficially through the weight of the inferior part of the trunk and of the lower limbs depending from the dorsal vertebræ, being calculated to elongate the ligaments and muscles upon the concave side of the curves, and temporarily to release the corresponding sides of the bodies of the vertebræ and intervertebral substances from the undue compression to which they are subjected in the deformed state. During the act of swinging, so long as the muscles of the trunk are actively influenced by the will, little or no straightening effect upon the column will be exercised. The patient must swing passively as far as the back is concerned, or the muscles of the back need to be fatigued before they will permit by this means any straightening effect upon the spine. Nevertheless it will be found on examining patients whilst thus engaged in swinging, that the weight of the shoulders being transmitted to the cross-bar is removed from the dorsal vertebræ, and that so long as this is the case the position of the spine is better. It is, however, not a reliable means in well-marked deformity; it is more beneficial during the earlier stages, and derives its principal efficacy from its partaking of a gym-

nastic exercise. *Mechanical elongation of trunk* has also been attempted by a variety of other suspensory apparatus; the patient, for example, having been suspended by the head in a suitable framework, without the feet being allowed to touch the ground. Many representations of this apparatus are to be found in orthopædic works. It is a sufficient condemnation of this proceeding to remark, that the connections of the upper cervical vertebræ with the cranium are less firm than those of the lapsed dorsal and lumbar vertebræ with each other; and that consequently a moderate amount of hanging will rather tend to separate the atlas from the occipital bone than cure deformity; besides which, cases are actually recorded of injury and disease of ligaments of cervical vertebræ having been produced by it. As if to solicit danger, some orthopædists, not content with simple suspension by the head, the weight of the trunk and members constituting the measure of the extending power, have added weights of 20 or 30 lbs. to the feet to increase the effect of the suspension. Heine practised suspension by the head combined with sea-bathing, the person being let down from a ridiculous cumbrous wagon, and allowed to practise a sort of gymnastics in the water. Extension in the *horizontal* position has been even more widely practised: it has been conducted harmlessly compared with the rude suspension above described. Innumerable extension-beds have been invented, furnished with straps to fix the head, and contrivances for fulfilment of the indications followed under the third head of means used; the objections to any energetic attempt horizontally to elongate the trunk would be almost as great as the hanging process above described. The only benefit obtainable from an *extension*-bed is that the patient is, even by the gentle application of its power, excited if not coerced into quiet retention of a position desired by the attendant. The designing and manufacture of racho-orthopædic extension-beds have been carried to an extraordinary degree of intended completeness. One

knows not whether most to admire the ingenuity which has enabled the inventor to adapt his couch to every possible modification of distortion, and to fulfil on the one bed every mechanical indication, or to lament that so much talent has been expended principally with the result of merely influencing the imagination and the confidence of the sufferer or her friends.* Besides extension-beds and extension-perpendicular-suspending frames, extension-chairs have been employed; the patient undergoing perpendicular elongation from the head whilst the pelvis rested upon and was secured to a chair. Their effects may be classed with those of other active stretching apparatus. A less formidable proceeding, much employed by some authors, has been that of causing the patient to take exercise upon common crutches only. By this means the lower part of the spinal column is relieved of the weight of the shoulders and arms, and is thereby straightened; but little benefit is exercised upon the more important dorsal curve. The influence of the weight of the head upon that part of the column which it especially and primarily influences, viz. the upper part, is not modified by this proceeding. Locomotion upon crutches may, however, be advantageously practised in those cases of lateral curvature in which, whilst exercise in the open air is desirable, the laxity and flexibility of the column is so extreme, that every time the upright posture is exercised, the ligaments and muscles upon the convexities of the curves are injuriously elongated, whilst the intervertebral substances and bodies of vertebræ on the concave sides are compressed; and consequently the benefit derivable to the bodily health from out-door exercise is neutralised by the injury inflicted upon the vertebral structures.

5. *Surgical division of contracted muscles.* Racho-myotomy has been extensively practised by some orthopædic

* See particularly the profusely illustrated work of Humbert.

practitioners, under the erroneous idea that lateral curvature is chiefly dependent for its maintenance upon active retraction of certain muscles, and that section of the contracted parts would liberate the distorted vertebræ. Experience has amply demonstrated that this operation is fruitless. Unlike tenotomy of the limbs, spinal myotomy is not even capable of being successfully performed even in a mechanical point of view; for the spinal muscles, unlike the majority of muscles in the limbs, are not gathered into considerable tendons, the division of which relaxes a large amount of muscular fibres, but consist of large numbers of small muscles, not running in the aggregate a free course, but attached beneath to every osseous salient point; hence section of spinal muscles is followed by comparatively little separation of divided parts, and after healing of these re-contraction ensues, and leaves the parts as before.

6. *Recumbency* recommends itself as a natural means of avoiding fatigue and strain upon weak parts during the early stage of lateral curvature, often as a means of improving the bodily health (p. 388), and sometimes as a *pis aller* when the practitioner has witnessed failure of the means employed to arrest the progress of deformity, and concludes that at all events the distortion will not advance so long as the recumbent attitude is maintained.* When not immoderately prolonged, it is the simplest and safest of ortho-rachitic means, and may advantageously form at least a part of the treatment of every case. The

* Recumbency tends at least to prevent or diminish the compression of vertebral bodies and intervertebral substances; an organic change which constitutes so great a drawback to recovery. The following is an analysis of loss of height of vertebral column on the concavities of the several curves in a severe lateral curvature (4th grade), according to Cruvelhier (*Werner*, p. 105).—Four curves existed: 1, a slight cervical curve to the left, the measurement of which was purposely omitted; 2, a dorsal curve to the right, involving the dorsal vertebræ from the third to the eleventh inclusively; 3, a lumbar curve to the left, involving the twelfth dorsal and four upper lumbar vertebræ;

decubitus may be dorsal, prone, or lateral; often the position may be varied, according to the inclination of the patient and the nature of the occupation or amusement in which she may be engaged. The position will also be selected according to the extent or nature of other appliances (Nos. 3, 4, and 7) to be used during recumbency.

Gymnastics (p. 29) may be either general, that is, when voluntary exercises are employed with the general object of exercising and developing the whole frame; or special, when, according to preconceived views of the etiology of lateral curvature, particular parts only are exercised. Gymnastics have been much abused; young females having been excited to athletic feats and exertions beneficial or necessary only for the development of the frame of the male sex. They have been pushed to a dangerous extent, as when undue fatigue and exhaustion have been consequent upon them. It is now well known that excessive muscular exertion in youth has something lethal in its consequences. Even when not pushed to this extreme, impairment of nervous system, loss of appetite, debility of digestive system, often result. In the early stage of lateral curvature, every means calculated to strengthen the nervous system, augment the digestive and assimilating powers, is needed; and as extreme use of gym-

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4, a sacral curve to the right, involving the fifth lumbar vertebra and the sacrum.

Aggregate loss of height on the concave side of the bodies of nine dorsal vertebræ	$5\frac{3}{4}$	lines.
Ditto on the corresponding intervertebral substances	$11\frac{1}{2}$	,,
Ditto on the bodies of five vertebræ in lumbar curve	21	,,
Ditto corresponding five intervertebral substances	$17\frac{1}{2}$	,,
Ditto on fifth lumbar vertebra	2	,,
Ditto on intervertebral substances between the fourth and fifth lumbar vertebræ and that between fifth lumbar vertebra and the os sacrum	$3\frac{1}{2}$	,,
Total	$61\frac{1}{4}$	lines.

nastics produces contrary effects, it should be avoided. At the same time, it is well known that whilst *excessive* muscular exertion produces injurious consequences, the moderate use of the same means effects directly the contrary. Swimming is one of the best preventives of lateral curvature, and a most beneficial gymnastic exercise.*

Moderate, light, easy gymnastic or calisthenic exercises are of the utmost advantage in the early stage of lateral curvature, the primary or remote cause of which is constitutional debility,—a state so apt to be overlooked by the inexperienced; and the secondary causes of which are ungainly lax attitudes unavoidably assumed by the weak individual—occupations and positions either unsuitable to the age and condition, or daily assumed during too large a portion of time.

The normal growth and development of every part cannot take place unless every muscle and part of the frame undergo a suitable amount of use. It would be superfluous to occupy time in proving that often, in modern education and rearing of young people of both sexes, many muscles and parts can never be adequately exercised. Moderate and proper gymnastics supply this defect in education.†

Suitable games and gymnastic exercises in the open air,

* In no respect are the labours of our profession more certain of successful results than in the incessant efforts made to enlighten society on the prevention of disease. This is an important field of usefulness, not neglected even in relation to deformities: witness a work of Mr. Hare, at present advertised, on the prevention of lateral curvature.

† It is right to observe, that the undoubted increase of lateral curvature during the last half-century has produced greater attention to the necessity of corporeal exercises to young females, and in the best scholastic establishments moderate gymnastics form a part of education. The dietary, the hours of repose, and recreation, still require amendment in many *pensionnats* which have come under the author's notice. One of the first requisites a parent should inquire for in determining the eligibility of a school, is the existence of large play-grounds, for the absence of which "long walks" are not sufficient compensation. Experience has taught many parents that sacrifice of health, strength, and figure are lamentable drawbacks to the highly-finished education

when practicable, relieve the mind of the anxious, scrupulously attentive girl (the most apt to become deformed); they quicken the blood circulation — distribute it more equally to the extremities, surface, and internal parts; increase the activity of movement of contents of alimentary canal, favour defecation, and effect other physiological purposes upon which it is unnecessary to insist. The effects, already narrated, obviate some of the prominent symptoms of a weakly constitution. Many lateral curvatures in the first stage are entirely corrected by moderate general gymnastics.

Special gymnastics consist of the artistic and habitual exercise of particular parts with the view of augmenting the power of particular muscles. These special gymnastics are more specious than real, inasmuch as it is often impossible to set in action certain muscles without involving others during the movements effected. A common example of special gymnastics is the preferential or exclusive use of the left arm, recommended with the idea of augmenting the power of the muscles which connect the left scapula with the spine and ribs, and thereby drawing the lapsed dorsal vertebræ towards the left side. This extra use of the left arm is combined with the endeavour to swing by it alone by means of the common hand-swing (p. 378). Over-confidence in the efficacy of special gymnastics is founded upon too exclusive a reference to excessive use of right arm as a cause of lateral curvature. The turning of hand-wheel machinery, or the working of a pulley, either in the erect or recumbent position, is a piece of special gymnastics serving sometimes the double purpose of developing the

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and accomplishments acquired by ten or twelve hours of assiduous devotion to studies for two or three years at a "finishing" establishment. The evils resulting from premature and too-continued excitement of intellect and erroneous management are more to be regretted, as, with judicious arrangements, accomplishments and the highest order of education are compatible with retention of health and strength.

contracted side of the chest, and furnishing a certain exercise and employment during the monotony of protracted recumbency.

The Swedish exercises, which have gone the round of northern Europe, do not merit favourable mention; they are attended by a certain class of evils which approximate them to the so-called mesmeric passes, on the same level with which they may be placed. Any good they can realise may be obtained from the manipulations of a rubber or nurse.*

8. *Automatic exercise of particular muscles.* The observation of the effects of carrying weights upon the head in perfecting the normal development of the figure, and causing an erect stature in water-carriers in tropical countries, appears to have suggested the idea that benefit would be derived from increasing the weight to be borne by the spinal column. The proposal to carry a book or a weight upon the top of the head has been adopted as a means of straightening a laterally curved spine. The proposition already advanced, that the tone of the muscles and ligaments of the vertebral column is impaired previously to and during the early stage of lateral curvature, and that the larger the cranial development, the greater is the liability (all other things being equal) to lateral curvature, and the advantage of temporarily withdrawing the weight of the head, indicate the author's opinion, that however useful the carrying a burden upon the head may be in the development of a healthy organism, it is objectionable during the continuance of the deformity in question. Moreover, the utmost proportional or physiological development is attainable without adding to the weight of the head. The head alone is the weight properly adjusted to the condition of the spine by the Artificer of all things. The constant carrying of an additional weight by the healthy individual

* Reform. der Orthopedie. Werner: Berlin, 1851.

would develop the neck and shoulders beyond the normal, and remind one of the brawny figure of the porter,—precisely as ladies' arms may by immoderate gymnastics be made to resemble those of the dairy-maid. Brown's horizontal lever-belt may be reckoned amongst the means calculated to effect automatic exercise of particular muscles. Disuse of an arm or foot acts not only through the voluntarily increased activity of the employed member, but also automatically. Even the crutch employed in many supports (see Mechanical Supports, p. 375), resting below upon the left ilium, and extended to the arm-pit, when made longer than the ordinary distance from the axilla to crista ilii, is supposed to induce automatic activity of muscles proceeding from the scapula to the spine, and thus tend to draw the lapsed dorsal vertebræ, towards the left, into a right position.

It has been proposed to effect automatic exertion of the muscles of the left or reduced side of the chest by compelling the patient to lie on this side, or by placing a heavy weight on his side. By this means it has been hoped, expansion of the side being impeded, that greater efforts of inspiration in the part would ensue. This plan is contrary both to reasoning and experience.

The treatment of the deformity after pleurisy (p. 362) proves that lying upon the protuberant side of the chest causes increased efforts at inspiration and expansion of the collapsed or contracted side.

9. *The automatic rectification of equilibrium of the column* may sometimes be effected; as when the legs are of unequal length, and the spine temporarily or constantly distorted, the practitioner places an additional heel or a book beneath the shortened member, by means of which the spontaneous rectification of the column proceeds from below upwards. The extra heel leads to elevation of the depressed side of the pelvis, the lumbar curve is partially or completely effaced, and successively those of the dorsal and cervical regions.

Allied to this means is the acquirement of the habit of resting the body upon the limb opposite to that generally employed by weakly children. It is worthy of remark, that lounging, idle corporeal habits of youth, besides the evidence afforded of ill-regulated mind, are often a sure index of physical disorder, either of direct weakness, or of indirect debility from overloaded alimentary canal, constipation, errors of diet, want of relation between the hours of repose and exercise, &c. The mind is often, therefore, but secondarily affected.

10. *The topical application of medicinal agents,* such as embrocations, lotions, saline solutions, sea-water, hold a subordinate place in therapeutics, and their *modus operandi* and precise value do not require consideration in this place.

11. *Electricity.* The small estimation in which this potent agent should therapeutically be held has already been alluded to when treating of the means generally applicable to deformities, p. 45. Like the majority of paralytic and spasmodic deformities, though proceeding from a different source, lateral deformity of spine is not merely a local affection, and therefore it is not capable of being cured by a merely local remedy.]

The *indications* of treatment of lateral spinal curvature may be arranged under three heads: the first in importance consists in endeavouring to remove the primary cause of the deformity — debility, by improving the constitutional powers of the individual; in the second rank may be placed the application of mechanical means adapted to prevent the increase and to remove existing deformity; and the third indication consists in application of means to act dynamically on the spinal column, such as exercises.

It is unnecessary to devote more time to a description of the measures calculated to improve the general health: food in proper quantity and quality, good air, moderate bodily exercise, the exhibition of steel, iodine, vegetable

tonics, and laxatives, according to the peculiarities of individual cases. In very severe cases occurring at the period of life when the general growth should be most rapid, particularly if very great debility be present, you may for a time forbid exercise altogether. In these cases the patient should have the benefit of carriage-exercise, or in the summer season be permitted to recline in the open air during a large portion of the twenty-four hours. Entire suspension of corporeal exercise is highly prejudicial to persons in vigorous health, and has consequently been commonly considered equally inexpedient to persons debilitated, as in severe spinal curvature. The cases of persons in health and debility widely differ. The debilitated individual possesses little vigour to expend; if this be exhausted in corporeal exercise, none will remain for the due performance of the vegetative functions of the system. You will often be surprised to observe that a person extremely weak, labouring under spinal curvature, who has long struggled to improve her health by exercise and nutritive diet, continues daily to get worse, until entirely confined to the couch, after which a manifest improvement in every function ensues. Do not mistake the import of the advice I now offer you. Use entire repose in these instances during a limited period, as a means of improving the general health. It may be advantageous as a means of fulfilling the second indication, which I shall presently consider. Do not imagine that I recommend a confinement of months and years to the recumbent position as a means of curing spinal curvature.

The means of fulfilling the second indication (the application of mechanical means adapted to prevent increase and remove existing deformity,) will be more intelligible if you reflect on the physical condition of the spine. You perceive a weak column, unable, through want of firmness and tone, to support itself in the erect position, daily yielding from the perpendicular line, through the combined

influence of gravity and unequal muscular traction. You further observe, when the curvature is not of long standing, that the column is straightened on the assumption of the recumbent position. Is it not proper, under these circumstances, greatly to abridge the period during which the erect posture is attempted to be maintained, and thus be content to follow the course pursued by many nurses or parents who perceive a child's spine to bend beneath the superincumbent weight? Undoubtedly the most certain plan would be to confine the patient during the whole of the remaining years of growth, with the hope that if the column remained straight, or nearly so, at the period of completion of growth, it would not subsequently yield. This is an important part of the plan adopted by a gentleman now deceased, whose zeal in behalf of humanity and science is proved by the legacy of a large sum of money for the treatment of sufferers from spinal disease. Dr. Harrison, to whom I allude, attributed too much, in my opinion, to the adjuvant means contained in his "*system*," and too little to the influence of mere repose. I shall sufficiently discountenance absolute repose during long periods, as one of the means of curing lateral curvature, when I state that, in Dr. Harrison's hands, seven years did not always suffice for the attainment of his object; and that when persevered in during a much shorter period, the wasting of the muscular system generally is so considerable, that fears may reasonably be entertained that recovery therefrom may never be effected. According to the urgency of the case, you may, however, have recourse to recumbency during four or six hours daily, divided into two or three portions.

The necessity of relieving the column of as large a portion of the superincumbent weight as possible is generally acknowledged. Numerous spinal supports and corsets, invented by their manufacturers with the specific property of curing lateral spinal deformity, have, at all periods, been brought under the notice of the profession:

Some of these inventions, on the contrary, enjoy a dishonourable privacy; their nature, if not their merits, being carefully concealed. The greater number of them answer in some degree the purpose of supporting the spine, being applied whilst in the recumbent posture; they resemble a cuirass or scaffold, against which the tottering or inclined spine finds a resting point. They are, as already shewn, not curative, and rarely prevent increase of deformity. Springs similar to a hernia-truss are often applied, through the intervention of the ribs, to the projecting parts of the column; but their utility does not equal the ingenuity of their application. Hossard's lever-belt, incorrectly termed Tavernier's, which I have for some time past employed, with some modifications,* approaches more nearly to a scientific apparatus for cure of lateral curvature than any other I have examined (see fig. 7, p. 34). The mode of operation of this apparatus in *rectifying* the position of the spinal column is simple. The pelvis affords a fixed point, so that the traction exercised upon the upper extremity of the lever by means of the laced belt acts powerfully and continuously, during all the movements of the frame, in compressing the ribs of the right side, and through their intervention, propels the lapsed dorsal vertebræ into the perpendicular position. The restoration may be facilitated by the weight of the upper extremities being partially removed by the addition of crutches. This apparatus possesses the advantage of not subjecting the thorax to any circular compression; the wasted left side of the thorax is perfectly free, and one of the earliest signs of improvement consequent on use of the apparatus is an evident enlargement of the capacity of this side. The relief experienced [from this apparatus, or from the Minerva and other well-adapted supports] is so great, that patients spontaneously remark the diminished fatigue with which

* The strap to pass beneath the pelvis, or the heel, is not mentioned in Tavernier's account of Hossard's apparatus.

they take exercise, and the greater freedom with which they respire. I have witnessed no instances in which the health of the patient has not at the same time improved. It is unnecessary to remark, that in the use of all mechanical contrivances for the relief of deformities, as much will depend upon the manner of application as upon the apparatus itself. Do not hastily attempt too much, but gradually accustom your patient to its use. It is well to remember the maxim, *arte non vi*, in this as in other deformities (p. 37). Benefit may also be derived by causing a shoe with raised heel to be worn on the side on which the ilium is depressed. It counteracts the habitual sinking of the side through the improper attitude instinctively assumed. It rectifies the position of the pelvis, and compels the spinal column to attempt, as it were, its own restoration (p. 386).

Manipulations, frictions, suitable exercises, modified calisthenics, as they are termed, by which the muscles of the upper part of the frame, particularly those of the left side, may be excited to activity and strengthened, serve to fulfil the third indication. It is necessary, however, to guard against too great exertion or fatigue. By judicious application of the principles I have laid down, and by availing yourselves of the practical hints I have given you, you may, in the majority of spinal lateral curvatures of not more than three or four years' duration [as at the age of from ten to fifteen], succeed in re-establishing the straight line of the spinal column.* It is more difficult to remove

* Lateral curvature of the spine is essentially a chronic affection ; its progress,—from the slightest want of correspondence of the hips or shoulders, and an amount of deviation of the spinal column imperceptible to the ordinary eye, to that stage in which one shoulder and subjacent ribs form an unsightly dorsal protuberance, the opposite axilla reaching to within a hand's-breadth of the corresponding hip,—occasionally occupies a period of many years. In the majority of cases the weakness is during several months entirely overlooked. During another period of several months, the simplest means of ameliorating the figure are resorted to, such as attention to attitude, gymnastic exercises,

the deformity of the ribs; those on the right side of the thorax are absolutely larger than those of the left, which have been imperfectly developed, through the distortion having so long existed during the growth of the body. They are not only larger but altered in form, and no means exist by which they can be wholly restored. This circumstance is of little moment beyond the traces presented of former spinal distortion, as proper arrangement of female dress and the skill of the corset-maker may conceal it. The principal object, *straightening of the spinal column*, being obtained, relapse of the form of the trunk, and the secondary evils of spinal curvature formerly enumerated, need not be apprehended.

Any surgical operation is unnecessary for the cure of moderate curvatures, and is ineffectual in the more severe forms of the deformity.

I will add an extract from the work of Stromeyer, *Ueber Paralyse der Inspirations-Muskeln*, and apply it to the views promulgated in these Lectures: "With the conclusion of these remarks the question may be asked: Whether these pathological notions will facilitate the cure of lateral spinal curvature? I believe I may answer in the affirmative, provided they tend to excite an interest in the study of this affection among medical practitioners; for the majority of these have hitherto spurned the investigation and treatment of these complaints, and have preferred

---

and the recumbent position. These means are often successful; but very frequently the mischief proceeds unchecked, or even becomes visibly aggravated. Sometimes the occurrence of indisposition, or a severe illness, withdraws attention from the minor evil of deformity until after convalescence, when it is found that, with greater general debility, the deviation has advanced with an accelerated pace. In like manner, the evil often appears stationary for months, or the increase escapes the watchful eye of the parent, rendered incapable of correct appreciation of the matter by too-frequent contemplation of the object. It is then a disorder of months and years' progress and duration, and, like all chronic affections, admits but of proportionately slow recovery.

leaving them to the shoemaker and machinist. The early recognition and successful treatment of lateral curvature can only be effected by a general diffusion of clear ideas of its nature. A correct pathology will exercise little influence upon cases of many years' duration, as these are incurable; but they may be alleviated, or their progress arrested,—a fact which neither the public nor practitioners have sufficiently recognised."

[The cases in which the cervical curve is slight or altogether wanting,—in which the column is still flexible,—in which the deviation diminishes when the patient assumes the prone position,—in young subjects, in whom the growth of the frame is incomplete, and in whom the general health, although weakly, is free from any decided constitutional disease,—are those in which treatment is most successful. These, indeed, are the cases for which the numerous plans of treatment advocated from the time of Andry to the present day are available. Much benefit from their use even in advanced cases is witnessed, although *cure* is unattainable. The attempt to *cure* inveterate cases of lateral curvature, if at the suggestion of the scientific and philosophic mind, can only end in disappointment; if at the promptings of the dishonest pretender, in painful delusion and victimising of the unfortunate sufferer. In incurable cases much may be effected in preventing further physical degradation of the spinal column, and of the important organs of the chest and abdomen dependent upon the adequate protection and support of the spine for their proper functions.]

APPENDIX.

Strabismus.—The eye is so delicately poised between the different muscles within the orbit, as to render it liable to be drawn from its proper position by the slightest deviation in the normal action of the internal or external recti. A transient or permanent deformity of congenital or non-congenital origin may thus be induced in the position of the eye, consisting either of an inward or outward inclination of the globe, commonly known as convergent and divergent strabismus.

The pathology of this affection is of interest in connexion with many of the deformities mentioned in this work (p. 106, &c.), both as illustrating how spasmodic action of a muscle may be the result of derangement either in the brain or spinal cord, or through the incident nerves, and how such a contraction may be relieved by mechanical means after the source of abnormal muscular action has been removed; and further, it points out how a weakened muscle may be elongated and overcome by a more powerful antagonist, which, in its turn, becomes structurally shortened.

The treatment, though necessarily modified according to the nature of the part, is the same in principle as that adopted for the cure of many other deformities. Thus we find that spasmodic action is relieved, first, by removing the cause, when practicable, and then by applying what may be said to represent the mechanical treatment in other cases, namely, by the use of darkened spectacles with central apertures, so as to keep the eyes in their proper position, or occasionally by covering the sound organ, while the distorted one is carefully exercised in the necessary movements in order to re-balance, as it were, the affected muscles.

Structural shortening of one of these muscles requires the same operation that has been recommended as necessary to relieve similar contractions in other parts of the body. And here Stro-

meyer's subcutaneous section of a tendon finds its counterpart in the subconjunctival method of dividing the internal rectus, such as is now generally adopted at the Ophthalmic Hospital in Moorfields and elsewhere.*

This last operation is somewhat more difficult of performance than the usual one, which consists in freely dividing the conjunctiva at a proper distance from the cornea, and then in passing a bent probe, or a small curved director, with a good sweep from below upwards and outwards so as to glide well between the tendon and the sclerotic; the muscle may then be brought forward and divided, either with scissors or by means of a bistoury, curved according to the fancy of the operator.

The subconjunctival method requires the head to be well supported by an assistant, and the eyelids to be widely separated by a self-acting speculum. If the patient cannot rotate the globe outwards, an assistant had better nip up the conjunctiva on the outer side of the cornea, so as to draw the eye into the necessary position. The operator then seizes the conjunctiva between the forceps, above half an inch internal to the cornea, and a quarter of an inch below the horizontal section of the eye; a small opening is then made with narrow probe-pointed scissors, so that a properly curved blunt hook may be easily inserted and passed, as directed, above, in order to get well between the muscle and the globe. The scissors may next be inserted through the superficial opening, and made to nip carefully through the structures raised on the hook beneath the conjunctiva. After dividing as much as is deemed requisite, not forgetting the bands of cellular tissue which somtimes interfere with the success of the operation, the hook may be withdrawn, and the position of the eye examined. If the direction of the globe is in any way deformed, the hook had better be reinserted so as to endeavour to bring forward within the reach of the scissors any other contracted fibres to be divided.

* Stromeyer was the first to propose the application of tenotomy or myotomy for the cure of strabismus, and received a prize of 4000 francs from the French Académie de Médecine for the discovery. Dieffenbach received a similar prize for having been the first to carry Stromeyer's proposal into execution.

By adopting this subconjunctival plan of division, the patient is not only secured from the exuberant fungus which sometimes results when the conjunctiva is more freely divided, but the eye does not afterwards present the same sinking-in on the inner side of the globe and of the caruncula, which can be observed when the former method has been adopted.—(GOWLLAND.)

ON RELAPSED OR NEGLECTED CASES.—It was the author's intention to have added some full details of the treatment required in different forms of deformity which have either relapsed after the restoration was far advanced, or which have been so neglected during the treatment as to constitute cases of incomplete restoration. The subject is one of much importance to the credit of orthopædy, and especially of tenotomy, for the cases are numerous in which the fruits of this operation have been lost from different causes. The length to which this work has already extended precludes any thing further than brief allusions to the more pressing cases which present themselves in consultation. The author's experience of relapse embraces many cases treated by himself several years ago. Thus, although the great majority of the cases appended to his *Treatise on Club-foot*, 1839, have remained "cured," No. 2, for example, has required repetition of the operation, but is now an active cavalry officer. No. 12 has needed much attention. No. 16, in which recovery appeared perfect, as shewn by the woodcut attached to that work, suffered relapse in one foot and repetition of section of T.-Achillis, with division of anterior and posterior tibial tendons. The subject of this case subsequently became affected with hemiplegia, one of the few instances the author has witnessed of the occurrence of a direct disease of nervous centres after congenital Talipes. No. 18 partially relapsed, but recovered with the aid of manipulations and instrumental treatment, and is now a robust, active man. No. 23 subsequently occasioned much trouble, owing to the cicatrix of the slough, which had resulted from pressure against cuboid portion of the involuted sole. No. 32 is alluded to here for the purpose of stating, that although treated without operation, the cure has continued perfect, the subject being at present actively engaged as a student of medicine.

Some of these references to cases treated by the author pre-

viously to 1839, and many others that have fallen under his notice, will suffice to shew that these observations on the causes and the mode of rectification of relapsed or neglected cases are not superfluous.

A formidable cause of return of deformity after treatment, conducted with or without operation, is, that whilst the elongated muscles and tendons are, from more or less protracted duration of the deformity, inferiorly organised and grow less than unaffected parts, the bones and the muscles upon the uncontracted side of the member having been but slightly, or not at all, implicated in the original cause of the distortion, grow at a greater pace; and thus the mode of progress of the acts of nutrition favours a disproportion between the length of the moving parts (the muscles) and between one portion of the latter and the moved parts (the bones).

This *natural* tendency of deformity to return can only be obviated by the similar course necessary in any disease, viz. by the medical practitioner taking care not to regard a case as "cured" so long as a trace of contraction remains, and by sedulous use of means used for the "cure," viz. active and passive exercises, and sometimes by retentive apparatus.

It was natural that the promulgation by Stromeyer of subcutaneous tenotomy, by means of which as great benefit is obtainable in a few weeks as was formerly attainable in adults even after several years' assiduous use of instruments, should lead to the hasty employment of operative means by surgeons unprepared for the after-treatment. Besides which, the aid obtainable from simple division of one tendon was often believed to be sufficient even in a complicated deformity. Confidence in subcutaneous operation, and its application to several tendons affecting one articulation, has been progressive on the part of those who have specially devoted themselves to the treatment of deformities. Such persons now, in the treatment of T. varus of average severity, for example (p. 295), divide not only the Achilles tendon, but also those of the anterior and posterior tibial muscles. If the practitioner, from the belief in the sufficiency of section of one tendon, or from the want of greater operative experience, omit division of the latter muscles in cases in which their section is requisite, he may find that in spite of depression of the heel, he has not fully removed the in-

version of foot, and consequently he may witness partial recurrence of deformity.

Relapse of varus is oftener directly due to omission, by the parents or the patient, of proper active and passive exercises. The author recommends as a rule in relapsed cases, that re-operation be not indiscriminately employed. He has witnessed many unpromising cases, operated months and years previously, which have promptly yielded to mechanical and manual treatment.

Whenever the belly of the muscle is observed to be retracted, and the tendinous portion disproportionately long, the practitioner may safely determine that the maintenance of the deformity is due to shortened ligaments, or altered articular surfaces, and that repetition of operation is quite unnecessary. These observations are suggested by relapsed varus, but apply to numerous deformities in other parts of the body.

The author has been consulted in cases in which the condition of a patient has been aggravated by unnecessary operations, especially in paralytic or spastic deformities. The structural shortening in such cases is with comparative facility overcome, whilst operation cannot give power to paralysed parts, and is only useful as an exception in active spasm, the relief of which must be sought in means which fall under the province of the physician. An operation has frequently converted such cases into deformity of a different kind.

Retentive Apparatus (see also p. 47) may often consist of the mechanical means employed for the primary treatment of the deformity. Such apparatus is commonly too cumbrous or unsightly for locomotion, but is frequently available when it is desirable to use it during a portion of the day or the night only.

A brief description of the contrivances the author has introduced for some of the more common deformities will suffice to exemplify this subject, as, when the orthopædic student has acquired a knowledge of the application of a mechanical principle to one member or part of the body, he will be enabled to apply it to other parts.

Thus, after foot-deformities, when the anterior muscles of the ankle-joint have not yet obtained the power of balancing the pos-

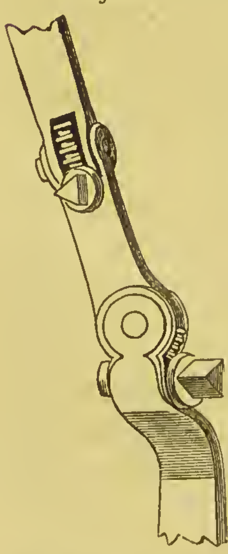
terior muscles, or when recontraction of posterior muscles is to be avoided, a simple instrument like that represented fig. 157 is applicable. A projecting stud or screw is inserted at the ankle-joint, against which a corresponding prolongation of the iron inferiorly is made to stop, when elevation of the heel is attempted. When free motion of the ankle is desired, the same boot is available upon removal of the screw.

Fig. 157.

In the opposite class of foot-deformities, when the weakness resides in the posterior muscles (calcaneus, calcaneo-valgus), the same contrivance is available, if the position of the screw be reversed, *i. e.* placed behind the inferior prolongation of the iron instead of being in front of it.

A mode of effecting the principal movements wanted in any apparatus for varus is added, fig. 158. The German orthopædists have long employed this power—*the endless screw*—as a means of extension. The fig. represents the ankle-portion of a supposed varus instrument. By the *endless* screw opposite the ankle, flexion or extension of the ankle at will is obtained; by the similar screw above the ankle-joint, placed in the opposite direction to the first, elevation or depression of the *margins* of the foot is obtained. The author several years since was indebted to Dr. Brown of Boston, U.S., for a specimen of a complete instrument for varus, in which the endless screw was introduced so as to effect the three movements required in varus, viz. depression of the heel, depression of inner margin, and eversion of the toes.

Fig. 158.



The endless screw as applicable to numerous orthopædic apparatus.

This instrument becomes a useful retentive apparatus when motion of the ankle is for a time undesirable:

but in consequence of its not permitting any voluntary movement on the part of the patient, it is for the general purposes of varus decidedly inferior to those represented in figs. 118, 119.

Experience shews that it is highly objectionable to maintain a limb many days and weeks in any instrument without manipulations or passive movements (pp. 37, 99). A certain mobility in a proper direction permitted to the patient tends to obviate the evil. The author has seen a varus too long left in an instrument (locomotion perhaps having been effected,) converted into a rigid calcaneo-valgus.

The endless screw is also useful on account of its great power as a means of "working" a joint "upwards and downwards" when manipulations are desirable, and no competent rubber is at hand for the purpose.

Fig. 159.

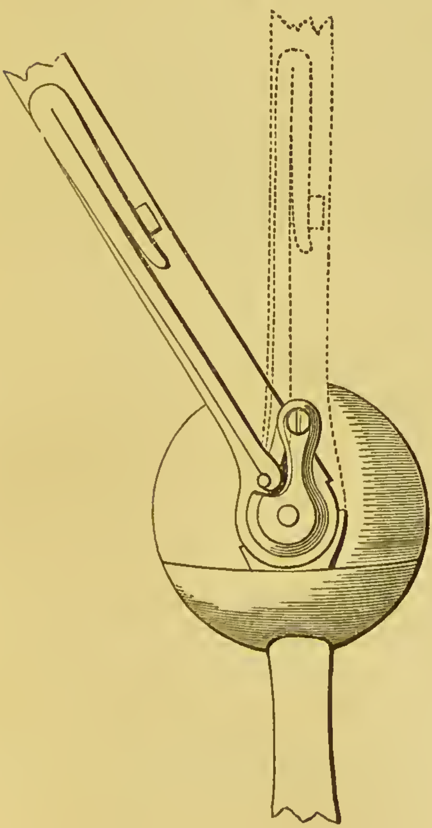
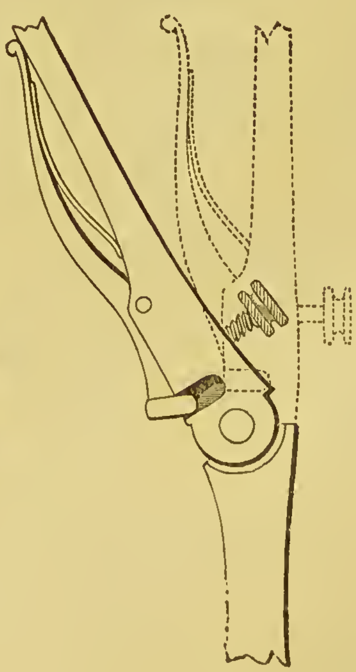


Fig. 160.



Figs. 159 and 160 are added for illustration of forms of retentive apparatus employed at the knee (made by the Fergusons, Giltspur St.); the first is available in the frequent case of debility of anterior muscles of the knee. The patient, by means of the spring there shewn, is permitted to bend the knee in walking, whilst the weak muscles are aided in stiffening the knee so as to prevent prosternation. The second (fig. 160) is applicable where locomotion with a stiff knee is for a time desirable, the spring-catch enabling the patient to bend the joint in the act of seating himself without exciting the attention of others.

Fig. 161.

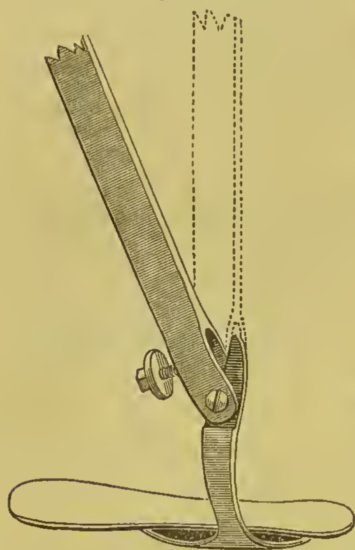


Fig. 161 exhibits a simple means of graduating the angle of the foot with the leg, and may be inserted almost unseen in a common boot.

The length to which this book has already extended prevents fulfilment of the author's purpose of inserting in the Appendix some other matters to which allusion has been made in the text.

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THE END.

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